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ABSTRACT

This document presents the complete report of the evaluation of eleven experimental projects funded by the National Science Foundation (NSF) in FY 1974-75 to increase the number of women engaged in science-related careers. The report includes a description of the evaluation methods used, difficulties encountered in making the evaluations, the design and synopsis of each project, reports of primary outcomes and materials produced by each project, project costs, comparative assessment of projects, and an overall evaluation with conclusions and recommendations. Recommendations include improving the quality of research in this area, coordinating research activities, continuing experimental activities including specific projects for minority women, and dissemination of developed materials. (SL)

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Final Technical Report
Contract #NSF-C1053

AN IMPACT ANALYSIS OF SPONSORED PROJECTS TO INCREASE THE PARTICIPATION OF WOMEN IN CAREERS IN SCIENCE AND TECHNOLOGY

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EXECUTIVE SUMMARY

This report contains the evaluation and impact assessment of 11 experimental projects funded by the National Science Foundation in FY 1974 and FY 1975 in an attempt to increase the number of women engaging in science-related careers. The report assesses both the individual projects and the collection of projects as a whole. The projects were conducted at: University of Kansas, Policy Studies in Education, Queensborough College, the University of Missouri at Kansas City, Rosemont College, Massachusetts Institute of Technology, two at Michigan Technological University, American College Testing and the University of Oklahoma. An addendum of the report will be prepared for Mary Baldwin College, the only project not yet completed.

Chapter I describes the evaluation methodology used by the Denver Research Institute. The methodology included an assessment of project documents, site visits, a participant impact survey, and the utilization of an evaluation form completed by both DRI and the project directors. The chapter also describes the difficulty in conducting the evaluation because of the many different internal evaluation instruments developed and used by the projects. In addition, the design of some of the projects for internal evaluation was not adequate to permit definitive conclusions.

Chapter II of the full report contains a synopsis of each of the projects. Each synopsis contains a description of the project as it was originally conceived, the project as it was actually implemented, obstacles to project implementation, a description of project personnel including role models, a report of the primary outcomes as described by project documents, by the data obtained by the participant impact survey, and from observations derived from the site visits. Each synopsis also contains a section on the secondary impacts of the project, the materials developed as the project product(s), and the dissemination strategies employed by project personnel. It also contains a section on project costs, including the estimated cost to reuse the curriculum products in other settings, and a section on recommendations and conclusions of the evaluation team. This chapter is deleted in the executive summary document.

The third chapter contains observations derived from the comparative assessments of the experimental projects with respect to their effect on professional careers, general career recommendations, reentry programs, and general administration recommendations regarding future program decisions.

The report contains several recommendations. Since the data did not provide a basis for conclusions, the evaluation team employed a "preponderance of evidence" approach to estimating the success of the projects. These estimates could not be used to indicate cause-effect relationships, so commonalities between the projects were proposed as hypotheses to be tested. They are summarized under three headings:

Hypotheses regarding programs to encourage the participation of women in science careers are concerned with:

1. Concentrating on women already interested in science
2. Concentrating on women with above average motivation and ability
3. Using workshops as a format for the treatment
4. Encouraging participant interaction
5. Using sustained periods of contact
6. Using role models in as many situations as possible
7. Using "hands-on" experiences
8. Segregating some activities by sex
9. Removing institutional barriers to participation
10. Aiming efforts at significant members of the community

A list of hypotheses or recommendations regarding general career education would be very long. However, two concepts are delineated as most relevant to science careers. These are:

1. Separating special science programs from general career education
2. Emphasizing the importance of mathematics preparation

The hypotheses regarding reentry programs for mature women are related to:

1. Concentrating on underemployed women
2. Considering the employment prospects in the locale
3. Funding projects to update skills
4. Enhancing the job readiness skills of the participants
5. Increasing the assistantships for mature women continuing their education

The general administrative recommendations for use by NSF are:

1. Improving the quality of the research, including
   a. more selectivity in funding
   b. providing technical assistance to project directors and
   c. using standardized evaluation tools

2. Coordinating intergovernmental and interagency activities

3. Continuing experimental activities by NSF

4. Including specific programs for minority women

5. Attending to the continuity/institutional problems of the funded efforts

6. Disseminating the developed materials

7. Systematic study of the effects of:
   aggregating minorities/women;
   the attitudes of the male science establishment and
   the effect of "significant others" in a real time situation

The appendices contain a list of alternative interventions. They begin with a list of psychological, sociological and institutional barriers to the participation of women in science-related careers. Some assumptions are delineated, and different kinds of interventions or treatments that might be used are proposed. Each of the suggested interventions is categorized by educational level; e.g., elementary school, high school, college, graduate school, reentry and post-employment programs. The appendices also contain a sample of the evaluation collection sheet used by DRI, a sample of the participant impact survey and the cover letter accompanying it; a bibliography of selected programs similar to the NSF projects, a film bibliography, a selected bibliography of the literature, and a selected annotated bibliography of the literature. These are not included in the executive summary document.

CHAPTER I
INTRODUCTION

According to the NSF Bulletin (E-74-1) announcing the educational programs for the fiscal year 1974, among the program goals were "increasing the flow of women into careers in science" and "discovering effective mechanisms for increasing participation of women in scientific careers."

The National Science Foundation funded eight experimental projects in 1974 and four in 1975 in an effort to meet these objectives. Projects had budgets ranging from $20,000 to about $100,000. The educational level of the women they addressed ranged from the secondary level to college, and postgraduate/reentry age groups. Each approach was somewhat unique. This report contains an evaluation of 11 of these projects.*

The program strategy chosen by NSF was to fund a small number of disparate projects, to assess their effectiveness, and to utilize the results in future planning. While this is a viable and cost-effective approach, especially in areas where little is known about effective programs or mechanisms, it presents many difficulties for the evaluators of those programs.

Because of the desire on the part of NSF to have feedback as quickly as possible upon which to base their future program decisions, most of the projects were funded for a one-year period and were required to have an "internal evaluation" component. This "internal evaluation" most frequently translated into an experimental/control group design. The most reliable measure of effectiveness is an actual increase in the number of women pursuing science-related careers. However, this dependent measure is not viable for a one-year project since the participant's appearance in the labor force may be four to ten years in the future. Therefore, the majority of the projects choose some measure of attitude or knowledge change over the year period, or an interim behavioral measure, e.g., science course, declared major, etc.** Further, no valid instrument exists designed to reflect changes in career options, awareness of career potential and/or career plans. Consequently, the majority of the project directors were forced to design their own evaluation instruments or attitude questionnaires. This situation was disadvantageous for both the project directors and the evaluators. First, validating a questionnaire and assessing its reliability is a complex, arduous, and expensive undertaking that requires considerable sophistication in the rather narrow area of testing. Second, with a pre- and post-test design even the most reliable and valid attitude measures frequently fail to reflect changes in attitudes because of "sleeper" effects or other variables. Even then, reported attitude changes may not be translated into behavioral changes. Third, many different and unvalidated self report instruments were used to develop dependent measures. For all these reasons, the project evaluations or experimental outcomes cannot be considered definitive.

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*Those completed as of this date. An addendum report will be issued at the completion of the Mary Baldwin project. [Note: The report on this project has been added following page 96.]

**Several of the projects are conducting long-term tracking at their own expense.

Another factor limiting the Denver Research Institute evaluation effort was frequently a less than adequate design and analysis of the experimental intervention. Almost without exception the project directors appeared very committed to and well versed in women's problems and science subject matter. Most, however, did not have extensive experience in project evaluation and/or experimental procedures. Given the desire of NSF to produce "hard results," one possible remedy to this situation may have been for the Foundation to provide guidelines for data collection to the project directors or to provide technical assistance in their evaluation efforts.

The task of Denver Research Institute, then, has been to compare "apples and oranges," e.g., different experimental treatments measured by idiosyncratic instruments which have no reported reliability/validity data. Since the typical project did not result in statistically significant results, the evaluation team had to resort to more subjective judgment than proposed. This judgment has covered the outcomes, and impacts, project personnel and processes, and project materials.

Methodology

The information for the evaluation effort was collected several different ways. Copies of all the documents produced by project personnel were studied. Site visits were made to most of the projects. During the site visit, the evaluation team interviewed project personnel, participants, role models and consultants. After the site visit, the team completed the form outline given in Appendix B. The form was slightly modified and sent to project directors to complete in order to verify the evaluation teams' perceptions and/or to correct any erroneous conclusions, as well as to provide data the team may have omitted.

In an attempt to "standardize" the outcome measures of the projects, the evaluation team sent out a short independent "participant impact survey" to the project participants whose names were provided by the project directors. A copy of the postcard survey and a sample cover letter are given in Appendix C. While the results of the survey are given for most of the projects, the list of names given was frequently incomplete, and a number of the addresses had been changed. Further, the participants who responded may have represented a biased sample. Therefore, the results of the survey are compared with the experimental outcomes and impressions formed during the site visits in an attempt to offset the limitations of each of the three methods of data collection.

CHAPTER II
PROJECT SUMMARIES

A. "Increasing Participation of Qualified Women in Traditionally Male Science Careers"

University of Kansas, Lawrence, Kansas 66045
Project Director: Walter S. Smith, Associate Dean of Women
Project Amount: $12,745
Educational Level: Secondary

1. Proposed Project*

The project was proposed to test the hypothesis that if college freshman women who possess the necessary ability, become aware of the barriers and receive parental and peer support in their effort to overcome the barriers, then these women (the experimental group) will enter traditionally male science careers in a significantly larger proportion than a comparison (control) group which does not receive special treatment.

The subjects for this project were to be drawn from women seeking admission to the University of Kansas who possessed high science and mathematics ability, have taken high school science and mathematics courses adequate to pursue a college science major, but do not aspire to a traditionally male science career (defined as one in which males constitute more than 80 percent of the practitioners). Two groups were to be identified: the first, seeking admission in Fall 1974 (the comparison group) and the second, seeking admission in Fall 1975 (the experimental group). Each group was to have 100-150 members.

Members of the experimental group and their parents would be invited to separate, concurrent workshops in the Spring of 1975. The comparison group would not have access to the workshops in the Spring of 1975, or to any other aspects of the instructional treatments. Both groups were to receive the same post-tests, although the comparison group would receive the post-tests one year earlier than the experimental group.

The purpose of the student workshop was (1) to identify for each student aspects of her own self concept which may inhibit her choice of traditionally male science career, (2) to work in group life planning sessions to understand ways in which these inhibitions have affected her career choice and to broaden the range of possible career choices for each participant, and (3) to show the students how they can use the University's resources to pursue a traditionally male science career. At the same time, but in a separate workshop, the parents would be introduced to possible realistic career and life patterns for women and be given an opportunity to explore new career aspirations for their daughters.

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*Taken from "Brief Descriptions of 28 Studies and Experimental Projects Related to Careers in Science for Women Funded by the National Science Foundation for Fiscal Years 1974 and 1975." National Science Foundation, August 1975.

Following the workshop, the student participants were to continue a home course of study which would build on the workshop's objectives. This course of study, to be completed before the start of their first semester in college, would yield college credit.

The participants were to be encouraged to live in the same residence hall during their first year in college, so that they would be able easily to meet formally and informally to discuss problems, provide mutual support, and continue to make plans to overcome personal and external barriers to their pursuit of traditionally male science careers.

The two groups were to be compared at the start and end of their freshman years. Comparisons would be made in (1) career choice, (2) awareness of barriers which have impeded women's entry into traditionally male professions, and (3) success in personally removing barriers from entry into traditionally male science careers (e.g., expectation of personal career achievement, independence of spouse, and willingness to assume responsibility). Using the same testing procedures, the two groups will again be compared five and ten years after the start of their freshman year.

An additional result of this project was expected to be the development of an exportable package of instruction which could be used by other universities or by the high schools to increase the science career aspirations of their women students.

2. Implemented Project

The workshops went as planned, each with 12-19 participants. Five, rather than six, workshops were held because of an insufficient response in Kansas City. The emphasis on barriers was dropped in the workshops because pilot studies had demonstrated that it was a negative approach, sometimes creating anger and discouragement among the participating women.

The home study course, Women in Professional Careers, was offered by the University of Kansas for three hours of credit. Although some interest was indicated in this course at the workshop, only six of the women actually completed it.

Further, the intention for the experimental students to live together during their freshman year did not work out because of other variables, such as the necessity of living in scholarship halls, etc. Bi-weekly "rap" sessions were to replace the group housing arrangements. As of November 1975, however, very few of these sessions had taken place, and the attendance had been poor.

For all practical purposes then, the majority of the experimental group participated only in the single day workshop, with half of their parents attending a shorter workshop.

Recruitment and sampling. The selected sample was composed of women who (1) scored 27 or higher on the ACT mathematics and the natural sciences tests; (2) had completed three years of mathematics and two years of science in high school and (3) had applied to the University of Kansas for admission. All persons in both the experimental and comparison groups met these criteria. The criterion of not aspiring to a nontraditional science career was dropped so that women already choosing traditionally male science careers could receive additional support and could serve as role models for other women. The percentage of response (test completion) of the identified freshmen in the class entering in 1974 meeting the criteria was 77 percent or 110 women. Less than the expected number participated in the workshop. Of the 256 identified in the pool, 78 (28.5 percent) actually participated in the workshop. Almost 50 percent of the parents attended.

At the time the women were invited to the workshops, letters were sent to each of their schools explaining the workshop. The schools were invited to send names of qualified women. A total of 81 names was sent to the project personnel in response. Separate letters were sent to their parents. All letters contained a descriptive brochure with the invitation. Sixty of the workshop participants had been included in the original mailing and 13 had been named by the counselors.

3. Obstacles to Implementation

No severe problems in scheduling or workshop implementation were encountered other than attendance. Reasons accounting for the lack of participation in the workshops were speculated to be: (1) conflict with other activities, (2) travel distance to the workshop, (3) even though the "science" aspect was not emphasized in the invitation, many women had no interest in a science-related career, (4) some women perceived the workshop to be linked to attendance at the University of Kansas, (5) some women may not have been interested in career exploration because it was held late in the senior year (April and May), and (6) some women may have perceived the workshops as "women's libber" activities.

The problems in getting the young women to complete the home course of study were apparently due to other summer commitments. The evaluation team does not have any additional incentives to suggest in addition to college credit that could be employed prior to college entrance to facilitate participation in the course. However, the course could either be used as an on-campus course, and/or as the basis for the "peer support" group.

The aim in housing the young women together was perhaps unrealistic given the character of the campus and the diverse constraints, interests and friendships of the young women. The poor attendance at the "support sessions" would appear to be an ongoing problem; the women reported that there always seemed to be work pressure and exams. Participation in the rap/seminar sessions, however, might have been increased by an earlier start in the semester, and by a more concentrated effort in planning by the project staff.

4. Project Personnel

The evaluation team was impressed by the depth of resources available to the project personnel. The project personnel who were interviewed were competent and had an unusually mature commitment to career/life options for women. The project director, a male, is vitally concerned about women's issues. Both by his views and his lifestyle, he was a positive influence on the program and should be a good role model for young males, as well as encouraging females in alternative lifestyles.

During the site visit, some of the role models were also interviewed and positively impressed the evaluation team. Judging from the participants' enthusiastic response, they were also very persuasive speakers. The project also appeared to have had (and has) a high degree of support from the institution; especially the office of the Dean of Women. For example, the Dean's Office is absorbing the cost of continued updating of career plans of the comparison and experimental group women.

5. Primary Outcomes

a. Experimental outcomes (internal evaluation).

1. Although there was a slight, nonsignificant decline in science career choices between the high school senior year and the end of the first year in college, approximately one quarter of the comparison (control) group women chose traditionally male science careers.

2. At the end of their first year of college, the comparison group women who chose nonscience careers were less certain of their career choices than were the women who chose traditionally male or not traditionally male science careers.

3. Women in the comparison group who had chosen traditionally male science careers in their high school senior year were more likely to switch away from these kinds of careers in college than were other women likely to switch into traditionally male science careers.

4. When the comparison group women listed barriers which women face in pursuing professional careers, they most often listed lack of educational or employment opportunities. However, when presented a list of barriers, the comparison group women most often asserted role conflict (between pursuing a professional career and the role of wife and/or mother) to be a barrier preventing women from pursuing professional careers.

5. Comparison group women most often asserted that role conflict (career versus wife and/or mother) had affected their career choice. However, women choosing traditionally male science careers significantly less often asserted that role conflict had affected their career choice, as compared to those women who had selected not traditionally male science careers or nonscience careers.

This summary taken from the final report deals only with the comparison group data, separated by a year from the experimental group. Data on the experimental group and the second comparison group (those women invited to the workshop but who did not attend, but who subsequently attended the University of Kansas [n=32]) are still being collected. The data* show a much higher percentage of the experimental group pursuing traditionally male careers at the end of the first semester of college, although no differences were seen during high school in any of the three groups. As measured after the end of the first semester, 26.5 percent of the comparison group listed their first career choice as a traditionally male science career (a decline since high school) while 48.6 percent of the experimental group were planning a science career (an increase since high school). However, the second comparison group, women invited to the workshop but who did not attend, also showed about the same percentage (50.0 percent). There are several alternative hypotheses for this increase in choosing science-related careers in the 1975 experimental and comparison groups. First, it could reflect changes independent of the "treatment" or workshops. Second, it is possible that the invitation to the workshop was as effective as attendance at the workshop. Third, the group being invited may have had contact with and been influenced by the experimental group of women. Finally, and perhaps most probable, is a changing trend over years, e.g., the first comparison group entered a year prior to the experimental intervention.

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*Walter S. Smith, "Science Education in the Affective Domain: The Effect of a Self Awareness Treatment on Career Choice of Talented High School Women." A paper given at the National Convention of the National Association for Research in Science Teaching, San Francisco, April 1976.

b. Participant impact survey. A total of 58 participant impact survey forms were sent to participants of the University of Kansas experimental program. Thirty-nine (67 percent) of the participants returned the form.

Of the 39 participants returning the impact form 36, or 92 percent, were currently taking a math or science course. Only two of the 36 reported were taking the course as a result of the program; the remaining reported would have taken the math or science course whether they had had the program or not.

Three-fourths (74 percent) of the respondents indicated they had chosen a math or science career. Ninety-three percent of those choosing a math or science career stated that they would have done so without the program. One respondent chose a math or science career as a result of the program and one respondent was uncertain if her decision to enter a math or science career was a result of the program or not.

The responses appear to have either been biased toward those choosing a science career or a continued "switch" toward science is occurring in the participants. That is, a higher percentage reported pursuing a science career in the DRI survey than in the more recent project survey.*

The respondents were also asked to state what they felt were the most positive and less influential aspects of the program.

The most frequently cited positive aspects of the program were the use of role models, giving the participants the opportunity to meet women already successful in their careers (23 percent); support and encouragement from the program to enter their chosen career field (23 percent); information on career options open to women (28 percent); and peer group reinforcement in entering nontraditional careers (21 percent). Other positive comments included such statements as "the sharing that took place among the young women, and also with parents," "it helped me to know what to expect from college and there were people I met who I could talk to when I had questions," and "the fact that there was and is an organization which formally recognizes and encourages women into traditionally male careers."

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*The participant impact form did not distinguish between traditionally male science careers and traditionally female science careers, e.g., nursing may have been considered a science career by some of the respondents.

The most frequently cited negative or less influential aspects of the program were that there was too much emphasis on self awareness and self searching exercises (23 percent); the program was not oriented toward the participant's needs (21 percent); the program was just not very worthwhile for the participant (15 percent); and the complaint that there was not enough specific career information. Other negative comments included "too general," "to be quite honest, I really didn't understand the whole point of the program" and "not enough activities."

c. Site visit conclusions. While on the University of Kansas campus, the evaluation team visited with about 15 participants of the workshop. All of the young women interviewed were positive about the program and several discussed the importance of having their parents attend the workshop, by explaining that they had not discussed their career plans with their parents prior to the workshop and that most of their parents had been more supportive of their nontraditional aspirations than they had expected. Most of them said they had always been committed to having a career and appeared well motivated.

The women commented on several aspects of the program. First, several suggested using the "home study" course on professional women with a peer group, e.g., classroom situation. Secondly, none felt that the (deemphasized) section on "barriers" or obstacles to be discouraging. Third, some women thought the workshop should be limited to those who had already chosen science as a career. In contradiction to the comments on the impact survey, most of these women thought the workshop material on self awareness was excellent. Therefore, the hypothesis that the women had matured in the last year enough that the "self awareness" exercises seemed trivial in retrospect must be entertained to explain the data from the DRI survey. Finally, the part of the workshop they reported enjoying most were the role models.

The two students interviewed who had taken the home study course had enjoyed it and thought it was valuable.

6. Secondary Outcomes

There are two population groups that may have been impacted; the parents and the institution.

While the evaluation team did not interview any of the parents, most of the young women whose parents had attended the workshops perceived their parents as supportive and said that the workshops had initiated fruitful interactions between the women and their parents.

The second impact area is the Emily Taylor Resource and Career Center for Women at the University of Kansas. The evaluation team was very impressed both by the resource materials of the center, the wide range of activities sponsored by the center, and the genuine dedication of its personnel to the concept of free, informed and active decisions made by women in their lives. Since some of the personnel seemed somewhat discouraged by the current attitudes of the female students, the project had both a positive psychological, as well as financial, influence on the center's personnel.

7. Materials and Dissemination

A complete curriculum for both the young women and parents workshop is included in the report along with the instructors guide. The final report also includes the "home study" course curriculum. The interim report includes a Test of Women's Awareness of Barriers to Science Careers but does not provide any reliability/validity data on the scales.*

Negotiations are currently being conducted with the National Association of Science Teachers for distribution of the entire package.

A similar program is continuing at the University of Kansas.

8. Program Cost

The total cost of the program was about $16,800, including $4,100 of the cost sharing from the University of Kansas. Therefore, the initial cost per participant was about $155 ($16,800/108 participants and parents). The cost to administer this program was claculated on an estimated $6 of printing cost per participant. About 90 percent of the project was devoted to materials preparation. Therefore, the cost of setting up the workshops could be very inexpensive, and the cost would decrease as the number of participants increased. However, most of the participants interviewed did not feel that a large increase in group size was desirable. Therefore, a rough estimate of the cost to reuse the materials would be about $10 per person.

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*Some information regarding reliability is provided in Walter S. Smith, op. cit.

9. Conclusions and Recommendations

1. Although clear cut experimental findings are not available on the experimental group, the workshops were judged to be generally effective by the participants.

2. The participants judged the "role models" to be the most effective component of the workshop. They also commented on the fact that "someone was interested in their careers" and being made aware of the fact that women can and do become scientists.

3. No conclusions can be reached about the "home study" course, although the little data available suggest that it is interesting and well prepared. The evaluation team would like to see it utilized and assessed.

4. The materials are complete and in usable form. Additional dissemination strategies should be implemented to further their utilization.

5. Most other career workshop materials may also be effective with males and younger age groups, as well as persons of all abilities and motivational levels.

6. The housing and peer support groups may be more appropriate for upper class women and might meet with better success if structured around a task, e.g., a tutorial program, a special course, etc. An alternative might be to utilize the home study course on professional women during the freshman year.

B. "Science-Oriented Career Development Workshops
for High School Girls"
Policy Studies in Education, New York,
New York 10017 (Grant originally made to
Institute for Educational Development)
Project Director: Virginia S. Newton
Project Amount: $65,193
Educational Level: Secondary

1. Proposed Project

In this project a series of career development workshops were to be designed. The workshops were to be developed to serve as a model for use by schools as a whole package or as separate units for natural science, mathematics, or social science classes. They were to include two lifestyle workshops, three career-cluster workshops relating to three broad areas of science, and one integrating workshop. Five of these would be pilot tested in the first semester of the 1974-75 school year in one school; all would be field tested in the second semester in the first school and in a contrasting second school.

Project personnel were to include staff from Policy Studies in Education and Catalyst, a national nonprofit organization founded to expand career opportunities for college-educated women. They were to work with associates from selected schools. Female and male workshop speakers would serve as role models. An advisory committee was to function as a resource concerning specific content for the career cluster workshops.

The girls who participate would be compared with similarly selected nonparticipant groups with sixty persons in each group. They were to be at or above grade level and possessing the potential for entering scientific careers. Only women were to be included in the experimental groups, but men and women were to be contained in the control groups. Pre- and post-instruments would be used to assess initial levels and changes in the direction of the predicted student outcomes. Formative evaluation techniques, used throughout the project, were to furnish information on the reactions of the student participants, the school associates, and the workshop speakers.

The major comparisons in the data analysis were to involve participant vs. comparison groups; grade 10 vs. grade 11; non-coeducational vs. coeducational school settings; and socioeconomic/ethnic grouping. These major variables were to be examined in relation to such variables as career orientation, knowledge of scientific fields, college and career preferences, and sex-role stereotyping.

The project was expected to result in a full description of the model for use in other schools, a teacher's guide, a compendium of resources, separate guides for the individual workshops, career guidance materials, and a videotape to illustrate the workshop process.

2. Implemented Project

The program consisted of six career development workshops scheduled for double class periods for pilot and field testing, and fairly closely followed the proposed plan. However, an additional school was added in the field testing for a total of three to increase the number in the experimental group.

Recruitment and sampling. The recruitment was done through the school system, and not by direct contact with the young women. Scheduling arrangements, assignment, and notification of eligible women was also the responsibility of the school. Original contact was made with the school principals, and responsibility was shuffled down to other personnel.

Because of scheduling and space problems due to the two consecutive period criteria in the high schools, the number of young women in the experimental and control groups were reduced: instead of 60 in each, there were 30 in the experimental group, 27 comparison girls, and 19 comparison males. Moreover, some of the students did not meet the criterion of (1) at least grade level in basic skills, (2) expect to go to college, and (3) have the basic potential for higher level scientific careers. The reduction in the sample made comparisons between sex, socioeconomic levels, and grade levels impossible.

3 Obstacles to Implementation

As mentioned above, severe problems in scheduling were created because of the constraints of the two hour period and the agreement with the schools that the young women would be released from a gym class. Although this could have occurred to some extent in single session scheduling, it was compounded by attempting to free two consecutive hours for a select group.*

In addition, because of changes within the agency receiving the grant (the grant was awarded the Institute for Educational

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*Many of the extreme problems encountered by this project may have been exacerbated by the uncertainty and budgetary constraints prevalent in all New York City schools the year the project was implemented.

Development, but transferred to Policy Studies in Education), additional administrative problems were encountered with the subcontracting arrangements.

4. Project Personnel

The project director, Dr. Virginia Newton, is a very competent woman who had worked previously in the New York City school system. Unfortunately, she had little direct contact with the students. Considering the major problems with administration of the grant, and the scheduling problems with the school systems, it is remarkable that the program was completed.

The class teachers were one male with a background in English, and two other teachers who were females with a science background. Teaching in one of the classes was assisted by Ms. Susan Ebbs, of Policy Studies.

The evaluation team met only a few of the 37 role models. Each of these seemed to vary in effectiveness, according to the subjective reports of the student participants.

5. Primary Outcomes

a. Experimental outcomes (internal evaluation). An analysis of variance was planned to determine the pre-post treatment effect by sex, socioeconomic level and age group. Since the assignment of the sample was neither random nor counterbalanced, it was decided that an analysis of variance was not an appropriate tool. Other tests of significance were also discarded as inappropriate.*

On the whole, the changes on the items were small and likely would not have reached the significance level. Looking only at the direction of the change for the one school where pre-post test results** were reported, several tentative hypotheses may be suggested:

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*A *t* test of difference scores may have been appropriate and sufficiently robust if item independence and a normal distribution were assumed. The differences would have to have been very large or the variance very small to achieve significance. Several different types of nonparametric statistics might also have been applied.

**The timing and conditions of test administration were not contained in the final report.

1. The level of educational and occupational aspirations may have increased.

2. The range of nontraditional career choices may have decreased, as well as interest in science occupations. The test was constructed so that this may have reflected only the increased knowledge of these fields.

3. The students perceptions of the female scientist increased on evaluative and activity dimensions of the semantic differential, but decreased on the potency dimension.

4. The testing instrument was not sensitive enough to measure the differences that did occur.

The final report did reach certain conclusions regarding the most effective processes. These conclusions were: (1) the role models had the greatest impact on the young women, (2) the most successful format was some kind of "ice breaker" followed by a session of prepared questions from the students (formal presentations by the role models was not felt to be satisfactory), (3) the most successful role model was young, personable, at ease with the students, and had a lot of enthusiasm for her job, irrespective of its content, (4) a circle arrangement for the workshop was the most effective, and (5) the group size should be no larger than 12.

b. Participant impact survey. Impact questionnaires were sent to 28 participants of the Policy Studies in Education program by DRI. Ten (36 percent) questionnaires were returned.

Among the ten respondents, seven (70 percent) were taking a math or science course. Six of those reported they would have taken the course without the program, while one took the course as a result of the program. Six of the ten respondents were planning a career in math or science. Only one of the six reported planning such a career as a result of the program, while the remaining five reported they would have chosen a math or science career with or without the program.

Three of the responding participants are now planning a different career as a result of the program. However, only one of the three is planning a math or science career. The remaining seven respondents had not changed their career plans as a result of the project.

The most frequently cited positive aspects of the Policy Studies in Education program were the role models--successful women in scientific careers talking with and answering the questions of the participants (40 percent) and the career information gained from the program (40 percent). Among the other positive comments were "Learning newer and different methods," and "Proved that women can really succeed in the world if they really try and work hard."

In general, the comments were more frequently negative than in the other programs. The most frequently cited less influential aspect of the program was that it was boring (40 percent). Other comments included comments that there should have been more classes and workshops (20 percent); that there should have been more speakers (20 percent); and that the program was not oriented toward the participants' needs (20 percent). Other comments included "I didn't learn anything I didn't already know. I was brought up in a math and science oriented household," "There wasn't enough contact with men and women who have succeeded in their careers. We never visited men and women working at the same job," and "The program should be introduced to younger people; it might possibly have a greater effect on them."

These results do not appear to be congruent with the conclusions in the final report. That is, a larger percentage were now taking nonrequired math and/or science courses than indicated in their final report, and a larger percentage were planning a career in science fields. While the actual number responding may not have been representative, and was very small, the behavioral results may have been more positive.

c. Site visit conclusions. The evaluation team met with most of the young women from one of the schools representing a lower socioeconomic community, several of the role models and the project staff. The young women were quite vocal and enthusiastic about the course, although they admitted that they really didn't know what it was about when they signed up. Several mentioned that they now wanted a "career" rather than a "job." More of them were now considering college and said they were generally aware of a wider variety of occupational options. They said they had liked the small group experience and did not want to see males integrated into this kind of program. They liked the younger role models, especially college age, but thought the mixture of ages and levels of achievement was good. In general, they appeared to be much more interested in lifestyle questions than questions about occupational content. The most interesting finding was that although they had dropped math and science as soon as it was no longer required, 70 percent were now taking nonrequired math and science courses.

Close examination of the respondents of the survey showed that they were predominantly from the school where the site visit was made. Therefore, there was almost complete overlap with the students interviewed during the site visit (generally positive) and those responding to the survey (generally negative). Therefore, either the young women have changed their minds about the program or felt some pressure to be less than honest during the site visit.

6. Secondary Outcomes

As far as could be ascertained, none of the schools is continuing this curriculum. It seems likely, however, that its existence raised the "consciousness" of some of the teachers and counselors, and a more flexible teaching style was reported for one of the teachers.

Several of the young women reported that they had discussed the program in detail with several friends and parents.

7. Materials and Dissemination

The final report contains a teachers guide, explaining the purpose of the material and suggestions for its use, either as a package or as separate units in related subject classes. The "student log" for students contains the lessons, exercises, occupational information guides, etc. The report also contains a "student survey" which includes: (1) personal data, (2) a semantic differentiation, (3) future time perspective, (4) sex role attitudes, (5) aspirations, (6) interests, (7) occupational choices, (8) level of confidence about reaching goals, (9) work values, and (10) information on science related occupations. Although sections of these were modifications of existing instruments, no reliability or validity data are reported for them. A videotape of some of the sessions is also available as an "instructors aid."

Many of the curriculum packets were printed and sent to appropriate personnel. To the project director's knowledge they have not been used.

Although the proposal indicated that the materials would be made available to ERIC or ADI, no mention of dissemination activities is included in the final report.

8. Program Cost

The total budget for the program was $65,185. Therefore, the cost per participant for the original program was approximately $1,500 ($65,185 for 45 participants). The estimated cost to reuse is $300 for the teachers time, about $25 per role model ($300), and the cost of copying the 60 page log book (about $3.00). Therefore, DRI's estimates that, based on a class of 12, the cost per participant would be about $50.00 per student.

9. Conclusions and Recommendations

Many of these recommendations coincide with those included in the final report of the project.

1. Although the project did not serve to directly influence the number of young women considering a science-related career, most of the young women found it useful as career education and for future planning. On that basis, the evaluation team would like to see activity to implement this kind of program sponsored by the secondary school systems.

2. The role models appeared to be the most effective component in this project. An interesting comparison may be that the less able group was more interested in the lifestyle of the career women models.

3. This program may be more effective with high ability young women already expressing an interest in science careers.

4. The final report concludes that encouraging science interest should start at a younger age before interest patterns are crystallized, and this type of program might be implemented earlier.

5. It may avoid some of the scheduling problems not to attempt a consecutive two hour period, but have a regular class period.

6. A preference was expressed for all-female classes.

7. The materials package is complete and could be utilized at different high school grade levels either in its entirety or in sigments.

8. The process or administrative problems encountered by this project should be instructive to persons intending to work directly with the public school system in a sustained program. The problems are described in detail and without defensiveness in their final report.

C. "Development of Educational Materials to Recruit
Women Into Scientific Careers"
Queensborough Community College, Bayside,
New York 11364
Project Director: Dinah L. Moché, Department of
Physics
Project Amount: $20,129
Educational Level: Secondary and College

1. Proposed Project

Multimedia packets (including slides, written materials, and an audio cassette) were to be prepared on five living women scientists, representing a range of ages and diverse field of expertise. The packets were to concentrate on explaining the research work the women are doing but would include a small addition of personal data. Each woman was to be personally interviewed by the Project Director.

For evaluation, five selected educators in different educational positions would administer a questionnaire before and immediately after the use of the packets to measure their impact on the cognitive and affective behavior of students regarding careers in physical science.

2. Implemented Project

Six rather than five women were interviewed. Cassette tape, slides, and written material were abstracted from the interviews for the package.

Recruitment and sampling. For the evaluation, two of the five educators administering the materials volunteered and the remaining three were recruited. One of those volunteering was one of the project staff of the Policy Studies career workshops. All but one of the institutions were secondary schools, and one was a large university.

The sample consisted of 206 persons; 86 were males and the remainder females. Nine females were already interested in science careers and were at the univeristy level.

3. Obstacles to Implementation

No specific difficulties in completing the package or administering the evaluation are reported.

4. Project Personnel and Consultants

The six women incorporated in the multimedia package come from a variety of backgrounds: they represent astronomy, biophysics, engineering, nuclear physics, science and society and space-life science. All but one of the women have doctorate degrees. The women represent white, black and oriental ethnic backgrounds and a variety of lifestyles.

The collection represents some of the top women in science today, each of whom have shown great accomplishments. The media package presents the extraordinary woman who has succeeded, and likely instills pride in being female. None of the women, however, would be easy for a young high school woman to identify with.

5. Primary Outcomes

a. Experimental outcomes (internal evaluation). The final report shows no significant difference between either the pre- and post-test data or the control and experimental groups. It is unclear from the report who the control group was.

The evaluation team attempted to obtain the raw data. The original comparisons grouped all students together irrespective of age, high school or sex. It was felt that a different grouping of the sample might show stronger trends. Further, it was felt that a statistic other than a $\underline{t}$ test for means might be more appropriate (e.g., a nonparametric statistic, difference scores). Unfortunately, the data were not available, and the final report did not contain extensive information on the internal evaluation

b. Participant impact survey. No impact survey was sent to the participants because the project director did not have the names of the students.

c. Site visit conclusions. Because of the self-contained nature of the package, it was felt that a site visit would not produce additional information.

6. Secondary Outcomes

The evaluation team has no direct knowledge of secondary impacts. However, the package was used as part of another NSF-sponsored project (Policy Studies in Education). It is possible that the package influenced some of the educators administering the film.

7. Materials and Dissemination

The instrument developed as an evaluation tool is the Moché Student Opinion Questionnaire. The final report states that "Both test-retest and even odd reliability coefficients were generated. Both concurrent and predictive validity were generated." (p.4) However, none of these data are reported. While the questionnaire has the advantage of being short, the correct (desired) response to some of the items is not immediately apparent (e.g., "Universities generally offer the same proportion of science scholarships to males and females" and "Science can be just as financially rewarding for women as it is for men").

The multimedia package contains three cassettes, a written interview from each of the women, and from four to six slides on each woman. The written materials portray very bright women, some of their life experiences and some about the work they do. The tapes are of average quality* but the slides are very clear.

The distribution is being handled by the National Science Teachers Association and the American Association of Physics Teachers.

Descriptions of the material have been published in the Announcer (December 1974) and Science News (March 15, 1975), and a paper was given at American Physics Association in January 1975.

8. Program Cost

Twenty packets were produced under the grant. Judging from the proposal budget, more than half of the original cost was for labor and travel, with the remainder for equipment. The exact price of distribution for the packet has not been determined. It seems likely that the cost will be approximately $20 to $30. Based on a one time only showing in an average classroom, the cost per student for reuse would be about $1.00.

9. Conclusions and Recommendations

1. The project exceeded its contractual agreements (six interviews rather than five) in the allotted time period. The packet is transportable, convenient, inexpensive and

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*The evaluation team played the cassettes on good audio equipment and still had some difficulty understanding all of the interviews.

of good technical quality (although the cassette requires a good quality deck for reproduction).

2. The effectiveness of the package in changing attitudes cannot be assessed from the design of the internal evaluation and the data analysis.

3. The packet would appear to be easily combined with any other program, and applicable to a wide range of age groups from junior high to reentry groups.

4. Dissemination activities have been conscientiously conducted, although the current status of the copyright is not known by the evaluation team.

D. "Preparation of Ancillary Materials for, and Formative Evaluation of, a Film on Women in Engineering"
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139
Project Director: John T. Fitch, Center for Advanced Engineering Study
Project Amount: $35,919
Educational Level: Secondary and College

1. Proposed Project

The Center for Advanced Engineering Study at MIT has completed the first version of a film ("Women in Engineering"), which is designed to motivate young women in high school and the early years of college to consider careers in engineering. Produced in cinema verite style, it presents engineering students and professional women engineers in school, at work, and at home. Showing these women in discussion groups, in the classroom, and on the job, it was hoped, would provide an understanding of engineering, dispel some of the myths and stereotypes surrounding engineering, and provide female role models. NSF funds were to be used for the preparation of guides for students and educators, for a formative evaluation of the effectiveness of the film and the ancillary materials, and for modifications of the materials based on the findings of the evaluation.

An important component of the work was to be a two-stage evaluation of the proposed materials. Two major purposes of the evaluation work were to be: (1) to provide feedback to the filmmakers and writers that will facilitate and strengthen the development of the proposed materials; and (2) to document the effectiveness of the materials when used in a variety of settings.

A number of questions have been posed to serve as a framework for the evaluation study:

1. To what extent does participation in the proposed project broaden students' understanding of the field of engineering--in terms of its function in society and the range of career opportunities?

2. What impact does the film, the ancillary materials, and related classroom discussions have on students' attitudes and concerns both toward engineering as a career and toward the role of professional women engineers, in particular?

3. Do students develop a clearer understanding of the the skills and interests needed to enter the field?

4. Are students better able to analyze their own abilities and interests in relation to pursuing a career in engineering as a result of having participated in this program? Do they demonstrate a clearer understanding of how they might pursue their interests in this field?

To address these questions, MIT planned to employ several complementary clinical and survey techniques to gather relevant data. Interviews with students and teachers were to be conducted using a semi-structured format and open-ended questions. Classroom observations were also planned. Data collected by these methods were to be used to illuminate quantitative findings gathered by means of written questionnaires. The questionnaires were to be primarily multiple (forced) choice in format, although they would also include a number of open-ended questions. In the first stage, trial versions of the film, student leaflet and educator's handbook would be tested locally in a small sample of classrooms (approximately five). During this period the evaluation instruments were to be developed and pre-tested. A questionnaire was to be administered to students in each of the classrooms; several students in each classroom and their teachers were to be interviewed; and classroom observations would be made during the viewing and discussion periods.

2. Implemented Project

One goal was added to the evaluation goals. The added goal was "what are teachers' and students' evaluation of the materials in terms of its strengths and weaknesses?" (p. 3 final report).

Although the exact sample to be used in the evaluation was not specified in the proposal, the experimental sample was comprised of 106 students from seven schools; 16 percent of these were male and 84 percent were female. About 20 percent were minority persons. They were in either tenth, eleventh or twelfth grades (3.5 percent, 13.2 percent and 62.3 percent respectively). Seven teachers were also included. The comparison group contained 109 students from different schools of approximately the same socioeconomic mix; 12 percent of the sample were male and 88 percent were female.

Both groups received the evaluation instrument a single time, e.g., a pre-post film exposure comparison was not considered appropriate for a short time period.

The evaluation instrument was an opinion questionnaire designed to assess the students interest in engineering, their understanding of the field requirements, their images of male and female engineers, reactions to women combining career/family roles, and their evaluation of the materials. In addition, semistructured interviews were given to the entire sample of teachers on an individual basis and a subsample of students in small groups. The interviews were designed to obtain in-depth opinions about the information presented in the film and booklet, as well as the material itself.

Recruitment and sampling. The final report on the evaluation indicates that several schools in the area declined to participate for reasons of conflicts in scheduling, reservations about the "controversial" nature of the subject, and the single sex orientation of the film. Nonetheless, the project personnel were able to obtain an adequate number of subjects across grade level who were predominantly college bound. The "recruitment" was done by working with school administrators and teachers rather than contacting the students individually.

3. Obstacles

No obstacles to conducting the evaluation have been reported other than those relating to obtaining the agreement of the schools to participate.

4. Project Personnel and Consultants

Since the "Project" is a media product, the attitudes and personalities of the project personnel are only important as conveyed in the material. A more relevant area of concern is the personalities of the people portrayed in the film and booklet. The film has been requested and not yet received. Therefore no judgments about its role models can be made. In the booklet, Choosing a Career Woman's Work: Engineering, interviews with three of the persons portrayed are given. One is currently at MIT as a student, one a middle-aged woman, and one a younger woman. The three have different lifestyles (one single, one a single/parent, one a married/parent), three different stages of professional development, and three different types of engineering. The role models come across as very positive about their lives in the booklet.

5. Primary Outcomes

a. Experimental outcomes (internal evaluation). The final report contains a complete description of the formative and impact evaluations and procedures.

One of the primary outcomes was that after seeing the film, significantly more students were now undecided about engineering as a career (27.4 percent vs. 10.4 percent) and a significantly larger percentage (51.9 percent vs. 28.3 percent) said that they were not interested in the field. It should be noted that students answered the questions about how they felt prior to seeing the film at the same time they answered the questions about how they felt after seeing the film. The film apparently confirmed questions concerning the unsuitability of engineering for them, but made it an interesting consideration for others. Interestingly, a larger percentage (6.6 vs. 1.9 percent) reported not "thinking about" a career after seeing the film. The percentage reporting that they had decided to become an engineer was identical both before and after the film (.9 percent).

The report states that the most intensive discussions among students and teachers "related to this dual role and questions of how to and whether to juggle a career--any career--with a family and home life" (p. 12). Young women appear to be more interested in how careers can fit into their lives, rather than the content of any particular occupational area. Interestingly, although 81 percent thought engineering was appropriate for a woman, only 55 percent thought combining a family and a career was a good idea for a woman.

Another outcome was that significantly more twelfth graders checked that the film was not related to their interest. This was interpreted to mean that most seniors had already decided what they would be doing for the next few years. The report concluded, then, that the film was more appropriate for earlier secondary years.

The outcomes of the comparison between the control and the experimental group were:

1. Significantly more of the comparison group were definitely not interested in engineering and more in the experimental group were undecided.

2. Significantly fewer of the students in the experimental group checked that male engineers worked with heavy machinery, while more of the experimental group checked that male and female engineers were creative.

3. There were no significant differences in students feelings as to whether engineering was appropriate for women as a career, but more students in the experimental group felt that the problems they encountered might be solved.

4. In open-ended questions the students in the experimental group listed engineers as needing creativity, problem solving skills, and sciences, while the comparison group listed working with machines (or their hands) and general intelligence, and the experimental group appeared to be more accurate in listing the necessary preparatory courses to be an engineer.

The formative evaluation and interviews suggested several other things. First, the report states that there was considerable interest in the lifestyle of the career woman. However, the most interesting part of the film was the content of the engineer's job and the most frequent criticism was a desire for more factual information about what engineers do. Suggestions also included shortening the student booklet.

b. Participant impact survey. Because of problems due to privacy considerations, the project personnel do not have the names of many of the project participants. The participant impact survey will be sent directly to the schools with a request that they distribute the form. The results will be included in the fall report.

c. Site visit conclusions. Because the project was a media product, not significantly influenced by personalities of the project staff, no site visit was made. Although the evaluation team recognizes that the personalities of the persons leading the discussions (teachers) may influence the pursuant attitudes, it was felt that this influence could not be adequately assessed under the conditions of the evaluation.

6. Secondary Outcomes

No secondary impacts are reported. It is possible that the existence of the project impacted some of the secondary school teachers as well as the MIT faculty working with it.

7. Materials and Dissemination

The final report includes a teachers guide, a booklet entitled Choosing a Career Woman's Work: Engineering and the film entitled Woman's Work: Engineering. The 25 prints of the film have been turned over to the MIT Educational Councils and is currently listed in the 1976-77 catalogue. The film has already begun drawing orders. The film was also transferred to quadraplex videotape for distribution to television. Requests for the film have been made by individual public broadcast stations and it has been reviewed by one educational television network. MIT also is negotiating with Education Development Center, Inc. which has experience in distribution to more than 60,000 school systems, to distribute the film and accompanying program materials.

8. Program Cost

The budget to the National Science Foundation states that $21,000 was spent to finish the film, about $9,500 for construction of the auxiliary materials, $2,000 for the film prints and $3,500 for the evaluation. The cost to reuse the film is currently listed in the MIT catalogue as $245 for purchase, $25 for rental. The teachers manual (16 p.) and the student handbook (20 p.) would be $25 + $36 copying expenses or about $2 a person to reuse the film package in an average class of 35 students.

9. Conclusions and Recommendations

Several conclusions may be made from the available data.

1. The film and booklet offered some concrete information about the field of engineering, and the requirements for entry.

2. The film and booklet encourage some awareness of women in nontraditional careers, e.g., it provided a means to explore the problems and rewards of women in professional jobs.

3. The dissemination activities incorporated in this project are excellent, and may be used as a model for other projects, although it is simpler to disseminate media packages, as opposed to a more complex program.

4. Recognizing the extremely small amount of money allocated to the internal project evaluation, the evaluation team feels that development of a more standardized measurement instrument by NSF would be especially useful; e.g., although the approach of congruent validity used in this study (use of different instruments conceptually related to arrive at a conclusion) provides a basis only for a more general interpretation of results. Further, although the use of the comparison group is good, the linking of "before I saw the film" and "after I saw the film" likely confounded the results. The report of the evaluation, however, is detailed and complete.

5. The evaluation team would prefer to see a greater number of males included in the evaluation of such projects, so the differences could be conclusively analyzed. Specifically, although males were included in both the experimental and control groups, no differences by sex are reported. It is assumed that either (a) no differences were present, (b) the differences were not analyzed or (c) the number of males in the sample was too small to reliably show any difference.

6. The materials are probably most appropriate for eleventh graders and tenth graders of high ability. They can be easily adapted for a single class period in any subjects related to engineering or career education. Since the impression made on males by the film were not discussed, the film might be most appropriate for career education classes, rather than science or math classes.

E. "Increasing Women in the Sciences Through an Experimental Mathematics Project"
University of Missouri, Kansas City (UMKC)
Principal Investigator: Dr. Carolyn MacDonald
Project Amount: $27,664
Educational Level: College
Project No.: GY 11326

1. Proposed Project

Thirty freshman women entering UMKC in the fall of 1974 were to be selected for participation in a project designed to increase the number of women in the sciences by reinforcing their mathematical skills. Students were to be selected for their potential ability to study successfully in the sciences. Selection would be on the basis of nationally standardized test scores. The group was to be divided into subgroups of those who expressed an interest in science and those who did not. All 30 students were to receive a specially designed mathematics course exclusively for women, with individualized and group counseling, personal assistance and tutoring, lectures, seminars, and field trips. Comparisons were to be made between the science-oriented and nonscience-oriented women on measures of achievement and satisfaction. Pre- and post-test measures of attitude were proposed. As a measure of project effectiveness the performance of the participants would be compared with students in other introductory math classes. The experimental group of 30 was to be compared with all students enrolled in Fundamentals of Math classes and also with women only along the lines of academic performance, professed interest in science, and attitudinal changes during the course of the year. As a measure of the effectiveness of the special course content and format separated from the effectiveness of the teacher, a follow-up study was proposed of students who were enrolled during 1972-73 and 1973-74 in standard sections taught by the instructor for the experimental course.

It was anticipated that the experimental project would provide information on which methods are most effective in the classroom and counseling situation and, if successful, would serve as a model for other college projects designed to encourage able young women to plan academic programs in science areas.

2. Implemented Project

The project was conducted as planned except for the qualifications and characteristics of the subject group, for which certain proposed measures were not recorded or analyzed. Lost in the design was the dichotomization of science-oriented and nonscience-oriented attributes, on which both achievement and satisfaction measures were to be reported. With 52 percent of the subjects reporting an interest in a science major (8 percent physical science, 44 percent biological sciences) on an initial classroom questionnaire, there appeared to be every opportunity to capture these data. Other discrepancies centered on the inclusion of several women students who did not demonstrate potential ability in the sciences. There were compelling circumstantial reasons for allowing these exceptions and in each case the exceptions biased findings against the experimental hypothesis, increasing the significance of the results.

a. Identification of participants. Thirty-two women students were enrolled in the first semester of the course. These were identified in the following manner. During the summer, the project director and a student assistant reviewed the applications, high school transcripts, and test scores of all women admitted as freshmen for fall, 1974. Possible participants were selected from those students who seemed to have potential ability for study in science, but who generally did not have strong mathematics backgrounds. The program was presented to them individually by the student assistant during the academic advising session of the freshmen orientation program. Each was given a brief written description of the program. All but one of the students whose schedules premitted enrollment elected to participate. Approximately 60 percent of the participants were selected in this manner. Twenty percent of the students were identified by academic advisors as advanced standing students who would benefit from special attention and assistance in mathematics. The remaining 20 percent were students who registered for the course due to an error at registration. Because their needs and problems were in many ways similar to the specially identified students, they were allowed to remain in the course.

The class composition for the first semester was therefore rather heterogeneous. The largest group, slightly over one-half of the students, were freshmen entering UMKC directly from high school. The remainder were divided among the sophomore, junior, and senior classes, and included transfer students as well as women who had returned to school after an absence of from one to 20 years. Ages ranged from 17 to 39 years, with about half of the students being 19 or under and one-fifth being over 30. Approximately half of the students expressed an interest in a science major.

b. The course. The course was specially developed for the project, but was offered as an experimental section of the existing introductory two-semester mathematics course, Fundamentals of Mathematics 110-120. The first semester is the equivalent of college algebra and the second semester is the equivalent of trigonometry and analytic geometry. The course content of the experimental and regular classes are similar, but with different emphases. The experimental course emphasizes basic skills and applications, while the regular course emphasizes theory and structure.

Several important differences between the first semester of the experimental section and the other sections are summarized below.

1. There were different instructors.

2. The experimental section consisted of 32 women students. The other sections averaged about twice that size and consisted of approximately one half men.

3. The course content was similar, but with different emphases. The experimental course emphasized basic skills and applications.

4. The experimental section had a daily group tutoring session, open only to members of the class. The other sections used tutoring sessions open to all students enrolled in the various sections.

5. The experimental section had occasional counseling sessions and guest lectures, which were not available to the other sections.

6. The students in the experimental section were specially selected and were aware that they had been invited to participate in a special program whose goals were to help women students acquire basic skills in mathematics and to open their career options.

The course was team-taught by Dr. MacDonald, the project director, and Ms. Barbara Currier, a doctoral student in mathematics. Both instructors attended the daily class sessions, alternating instruction in three-week blocks. The regular class meetings were preceded by an optional one-hour group-tutoring session staffed by an undergraduate student. The instructors often helped at this tutoring session and were also available to students who needed individual assistance and encouragement. There were occasional counseling sessions and guest lectures. The class had 15-minute open book quizzes weekly and regular one-hour exams every three weeks.

There were four class periods devoted entirely to supplemental activities during the fall semester and one class period during spring. These sessions consisted of talks from visiting women who discussed subjects relating to mathematics, counseling and administrative services, and career choices. The class also visited the UMKC computer center.

c. Special environment/materials. No special facilities were required for the delivery of the experimental mathematics course. Noon hour help sessions were held in a roomy laboratory adjacent to the regular classroom. The laboratory was furnished with tables that seat four to six students. The sessions took on both social and academic aspects with some of the students bringing their lunches and eating and visiting together as well as studying mathematics. The instructors shared an office across the hall from the tutoring room. An undergraduate mathematics major tutored daily and one or other of the instructors was available to give additional assistance. A special text was used for the experimental group that is more practical and problem-oriented than was the existing text.

3. Obstacles to Implementation

There were no major obstacles to the implementation of the plan. Some of the proposed project principals and consultants did not perform on the project, and some of the proposed measures were lost. However, nothing detrimental to the active conduct of the project was discovered.

Neither the Mathematics Department nor the UMKC institution has been especially cooperative, but neither did they impede the project. The project director was not permitted, however, to gather longitudinal (sequential) course data from student record files, information that could have been secured within privacy restruction regulations.

4. Project Personnel

The project director, Dr. Carolyn MacDonald, is an assistant professor of mathematics and physical sciences. Dr. MacDonald has a B.A. and M.A. in mathematics, an M.A. in physics, and a Ph.D. in Chemistry from Brown University. Her teaching experience at UMKC has been in both mathematics and physical science, in which she teaches an extensive survey course. She taught the existing Fundamentals of Math course for two years prior to the experimental semester. Dr. MacDonald's husband also teaches at UMKC and their two young children often visited their parents at school. Dr. MacDonald's students thus had an opportunity to see her occasionally in her family role.

Other proposed project personnel were not intimately concerned with the project. The teaching assistant position was filled by Ms. Barbara Currier (now Dr. Currier) who was completing her doctoral studies at the time. Although Dr. MacDonald had much more classroom experience, both instructors were competent to teach the experimental class from the viewpoints of both content/substance and sensitivity to the special problems of many women. The instructors complemented each other well. Ms. Currier is young, newly married, somewhat more reserved than Dr. MacDonald but equally attractive personally.

5. Primary Outcomes

a. Experimental outcomes.

Math Grades--Math grades were significantly higher for women in the experimental class than for either women or men in the control (standard) classes. However, the distribution of grades was interesting: 53 percent of the women in the experimental group received A, as did 25 percent of the nonparticipants (28 percent women, 21 percent men). However, slightly more women in the experimental group received D's.

	Exp. Women N=32	Control (Women) N=342	Control (Men) N=345	Total N=687
A	53.1	28.4	20.9	24.6
B	25.0	19.0	15.7	17.3
C	6.3	12.0	17.1	14.6
D	9.4	8.5	6.1	7.3
F	3.1	7.0	9.0	8.0
W	3.1	22.2	26.7	24.5
I		1.5	3.8	2.6

Percent Distribution of Grades

It is also interesting to note that university wide slightly more women than men (375 to 345) signed up for the math class, the women's grades in general were slightly higher than the men's and there were fewer women withdrawals.

Complicating the analysis is the lack of background data on participants and control groups relating to their high school GPA's and standardized test scores. Over 50 percent of the women participants anticipated careers in science, whereas only 34 percent of the nonparticipants intended to major in science-related areas. Additionally, the experiment included the simultaneous manipulation of several variables including all female classes, smaller classes, team teaching and content changes so that it is difficult to select which of these contributed most to the apparent success of the project. Further, different tests were used to assess student grades. This problem was somewhat ameliorated by the project director's recent and current experience with students in standard math selections. Spring quarter grade comparisons also show stronger grades for the experimental class as well as higher grades in general for females.

Subsequent Courses--Compared with 1972 and 1973 control group data, significantly more participant women chose a subsequent math course than did others. Even more impressive are the figures when comparing women control group members. Unfortunately the 1974 data were not available for this comparison with a more recent student cohort.

Exp. (Fall 1974)	Fall 1973			Fall 1973		
	Women	Men	Total	Women	Men	Total
37.5	12.1	33.3	24.4	2.6	24.0	10.9

Attitudes--Questionnaires relating to student attitude and background were distributed during the first month of the class. During the last week of the fall semester a second questionnaire asking for attitudes and assessments of the course was distributed. No attempt was made to relate individual before-after responses or to relate baseline attributes to either attitudes or achievement. Students in the control groups also completed the questionnaires. In the experimental section, only one-fifth as many students reported spending only zero to three hours of study outside of class, while four times as many students reported spending 12 hours or more. Almost twice as many students in the experimental section expected their course grade to be much better than most of their previous math grades and reported that their understanding of mathematics was much better and their interest in mathematics was much higher than before they enrolled in Math 110. Three times as many students in the experimental section said that they would recommend that friends take Math 110. Almost half again as many students plan to continue with a second semester of mathematics. In the experimental section 72.0 percent in contrast with only 8.5 percent of the other students felt that the textbook was much better than most textbooks. Although almost all students were generally well-satisfied with their instructors, the ratings were higher in the experimental group, with 84.0 percent giving the instructor an overall rating of excellent and 12.0 percent good, while in the regular sections the composite ratings of all the other instructors were 47.7 percent excellent and 40.1 percent good. No questionnaires were administered during the second semester of the project.

Career Plans (College Major)--The experiment did not provide for collecting relative information on career choices of participants and nonparticipants. On an informal basis the project director had information and reported on three special cases of students either electing scientific careers as a result of their exposure or opting for a more aspiring position within a profession.

b. Participant impact survey. A total of 37 impact questionnaires were sent to participants of the University of Missouri's experimental program. Eighteen (49 percent) were returned completed.

Of the 18 participants returning the impact questionnaire, 13 (72 percent) were taking a math or science course; two participants (11 percent) were taking the course as a result of the program, while the other 11 participants (61 percent) indicated they would have taken the course whether they had participated in the program or not.

Eleven of the 18 respondents (61 percent) indicated they had chosen a career in math or science. Four of these 11 respondents (36 percent) stating they had chosen a math or science career indicated their career choice was a result of the program; while the remaining seven would have chosen such a career with or without their experience in the experimental program.

Of the 18 respondents, 14 (73 percent) experienced no change in career plans as a result of the program, however, four (22 percent) of the participants changed their career plans in favor of math or science as a result of the project.

The positive aspects of the program according to the participants were the small class size, individual attention and personal atmosphere (39 percent); a new understanding and confidence in her abilities in math (39 percent); the instruction and textbooks (39 percent); and the information, encouragement and support in nontraditional career fields (33 percent). Among the less frequent comments were "I did not feel I had to compete with males," "First and foremost —Dr. MacDonald and her 'can do' attitude," and "The best and most unique course I ever had."

Responses on the less influential aspects of the program included comments that it was not a realistic situation with only females in the class (17 percent); the program did not have a good text (11 percent); the class should have been more similar in their math backgrounds--course moved too fast or too slow (11 percent); and the most frequently cited was "none" (33 percent). Among other comments were "A lot of work and class everyday, but it was worth the time and effort," and "As a history major I resented having to take math. I just took the GRE and could do little of the math section which proved what I thought--I got a 'B' in this math class, but did not learn anything that I retained--or that will be of use to me in my career."

c. Site visit. The University of Missouri at Kansas City is the site of a private university that had been unsuccessful and was recently taken over by the University of Missouri in order to serve the high population of students seeking state supported higher education in the urban area. The school is predominantly attended by local city students and is attempting to hold to high academic standards in an area where many students from the local school system are not especially well prepared for university study. For example, Missouri does not require any high school mathematics as a prerequisite for graduation. The UMKC does not therefore require mathematics prerequisites for entry but it is not possible to graduate from UMKC without either a foreign language (in which many of their students have no interest) or college level mathematics. The mathematics department does not seem especially interested however in offering the remedial math courses necessary for students to qualify for college level mathematics study. This is apparently a transition period for the University during which time it has to come to terms with faculty needs to teach advanced classes and student needs to compensate for their pre-college deficiencies.

At the time of the site visit in fall of 1975, both semesters of the experimental mathematics section had been completed, and the final report for the project was in preparation. We were fortunate, therefore, to be able to meet with the project director, her teaching assistant (who had a principal role in implementing project goals) and one of the two undergraduate mathematics students who tutored the participants. The evaluators also met and interviewed ten of the women who had been in one or both semesters of the course. Meetings were held in the laboratory room where students came for the tutoring sessions and in Dr. MacDonald's office. The meetings were with single students and with two or three at a time. Dr. MacDonald and Ms. Currier were present only for the introductions.

The women (who came to the session) were uniformly positive about the program and about the instructors, some almost to an extreme. Women who had been out of school for a while were the most enthusiastic about the program. When the evaluation team tried to probe the reasons for their positive attitudes in order to discriminate between the goals of self-confidence and improved mathematical learning, it became clear that in spite of the moral support, encouragement, and pleasant social aspects of the informal supportive all-female classes, students felt that the most direct benefits were increased learning in mathematics with about equal emphasis on concepts and skills. They seemed to feel that the supportive nature of the class was a mechanism for them to acquire those concepts and skills, but their satisfaction appeared to be with their performance in an area in which they had had little or no success in the past.

The evaluators met and spoke with the head of the Mathematics Department to determine the impact of the NSF-funded project on the institution. Reactions of the department toward the accomplishments of the experimental sections varied from apathetic to hostile, although it was acknowledged that the text used in the class will become standard and that "apparently" the participants did quite well and more went on into calculus than would have been expected to without the program. Even though participants covered more material than did the standard sections, the department viewed the class as "remedial" and was not supportive of continuing the program.

6. Secondary Outcomes

As reported above, no institutional impacts from project accomplishments are anticipated at the department level, at least in the short term. A request from the project director to apply for outside funds to teach a special class for older students was denied. It is possible, however, for delayed impacts to occur as the institution gets more pressure to become responsive to student needs.

The ten students interviewed were questioned as to parent-peer-sibling attitudes toward women in mathematics and women in science. The only impacts reported were from the four women in the group who were mothers of children old enough to comprehend the situation. They reported that their experience was somewhat inspirational to their daughters and educational for their sons. One woman spoke of helping her "chauvinist" teenage son with his trigonometry homework as one of the rewards of the project.

7. Materials and Dissemination

A standard text was used in both courses. The text, however, was new to the institution and is likely to be used in all sections.

The project was discussed at several mathematics meetings. Ms. Currier spoke at the annual meeting of the Missouri Section of the Mathematical Association of America. Dr. MacDonald appeared on a panel at the Association for Women in Mathematics national meeting and spoke at the Tulsa meeting of the National Council of Teachers of Mathematics. During the winter she discussed the project at a symposium on Women and Mathematics at the national meeting of the American Association for the Advancement of Science.

There were several newspaper articles written about the course and Dr. MacDonald in the UMKC newspaper and the Kansas City newspaper. Dr. MacDonald was the guest on a local television show and radio show, where she discussed women and mathematics and employment patterns of women. She also was guest lecturer at a workshop at the University of Southern Mississippi and appeared there as a guest on a television show. An article of Ms magazine on problems often encountered by women in the study of mathematics references Dr. MacDonald's work. Her frequent appearances in math colloquium have also given widespread publicity to the NSF project.

Ms. Currier is now a mathematics instructor at Rockhurst College. Her involvement in the project was considered as a strong positive factor in their selection of her over other candidates.

8. Project Cost

The project was funded for $27,664. Funds were to cover instructors, tutors, supplemental materials, travel, and honoraria for guest lectures. With a total of 54 students (32 students fall semester, 22 students spring semester) the cost per participant was $512.30. This figure includes administrative expenses, and cost of preparation, as well as implementation costs. Deducting the $8,830 budget item for indirect costs, the cost per participant calculates to $348.78. The estimated cost to replicate at the same institution on a nonoverheaded basis would be approximately $250 per participant. This figure does not include questionnaire and achievement score analysis. The cost to modify, replicate, and analyze at another institution would probably be close to the $350 per participant cost computed for UMKC.

9. Conclusions and Recommendations

1. There were several factors that were simultaneously manipulated with the experimental group that complicate the analysis of the contribution of any one of these factors. The course was team taught to all women, used a special text, provided tutoring sessions, had a smaller enrollment, and finally different examinations (content and format) than the control groups. The only valid measure to report is the percentage of women who elected additional math classes and went on into calculus. Unfortunately comparative information is not complete on this measure and the institution would not release grades in calculus.

   From informal mechanisms it can be reported that the percentage of women choosing subsequent math courses was higher than the control group, and compared to previous years was significantly higher than either men or women in standard sections.

2. The success of the class can be reported in terms of the attitudes of participants towards themselves and towards mathematics and science. A total of 61 percent of the postcard respondents indicated they were still planning on a career in science (approximately one-half the class had started with that goal). Considering normal science attrition rates, that percentage is impressive. Seventy-two percent of the respondents translated career goals into behavioral measures (additional classes). However, no baseline data for comparing control and experimental group on aptitudes and skills as measured by grade point averages or standardized tests were reported.

   The comparison of the impact of the course on science-oriented and nonscience-oriented women went unreported, and aggregate reports on percentages did not permit the examination of this phenomenon.

The general enthusiasm and acceptance of participants, tutors, and instructors indicates that the program had positive impact on them personally.

3. High on the list of attributes favored by the participants was the all-female environment (particularly for the older woman) and the supportive nature of the environment as permitted by the small pupil to teacher ratio. The project can be rated as successful in spite of the paucity of valid statistical data.

   It is difficult to sort out the most effective elements. Obviously some of the factors that contributed to participant satisfaction cannot be used routinely in math classes. It would be impractical to have all classes of men or women students only and few schools can afford to cut normal class size in half and at the same time assign two instructors and a tutor to each class. However, the supportive, can-do, atmosphere can be replicated on an extensive basis at no cost to the institutions. Until that time the lower teacher to student ratio and the special emphasis on helping women to reach their own levels of competence through elective all-female classes appears to be a helpful situation.

F. "New Opportunities for Women Chemists: Recovering Lost Skills"

Rosemont College, Rosemont, Pennsylvania
Project Director: Suzanne P. Varimbi
Project Amount: $34,043 (2 years)
Educational Level: Post-Baccalaureate

1. Proposed Project

The purpose of the proposed project was to (a) identify, locate, and invite the participation of women college graduates of the years between 1959 and 1968 whose major subject was chemistry but who had not worked as chemists since their graduation and would consider full-time employment if their knowledge and skills could be brought up to date; (b) offer a year of intensive contemporary laboratory work, supplemented by adequate review and updating in chemical principles in a lecture and seminar setting; (c) provide a working internship in an individual laboratory; and (d) offer career guidance and placement with suitable employers upon successful completion of the training.

The project was to be evaluated in terms of (a) the participant's satisfaction with the training program, (b) the success of the program in placing participants with chemical industries, and (c) the satisfaction of employers with the participant's training as demonstrated by her performance after a period of employment. The project was funded by NSF for $34,043 with approximately $11,000 additional of matching funds, $7,400 of which came from industry in the form of consultant services and visiting lecturers.

2. Implemented Project

The program was carried out as originally proposed, and consisted of self-paced review of basic concepts plus one unit course at the advanced undergraduate level plus a weekly seminar. The seminar included lectures by industrial personnel and discussions with Rosemont faculty concerning the review of basic concepts. Some general information regarding job opportunities and employer expectations was provided in the seminar. These were followed by special lectures on substantive work-related activities by the industrial speakers plus two site visits to nearby industrial laboratories. Participants were recruited via news releases, paid advertisements in local newspapers, posters that were displayed in nearby shopping centers and by spot radio announcements. Tuition costs were borne by the students. It had been anticipated that some of the area companies would offer financial assistance in the form of scholarships to the students, but the companies elected to make their assistance available in other forms, e.g., consultants, internships. The other deviation was a procedural change. The six-week paid internship program scheduled to begin mid-year was rescheduled for the summer months at the request of the participants who felt (1) it would be more convenient for them at that time and (2) they would feel better prepared after a full year in the program.

3. Obstacles to Implementation

The only problems facing the project director regarding implementation of the program was the difficulty encountered in recruiting the women already identified to be likely candidates for the program. Of the women identified (in terms of their education and articulated interest) only 12 started the program during its two years, and 11 completed the course. Project directors seemed to think tuition costs were the primary reason for the low participation rate, and began making vigorous efforts to get additional funding for tuition scholarships from foundations and from industry.

4. Project Personnel

Project personnel were as proposed. Dr. Varimbi, the project director, joined the Rosemont College faculty in 1965 and has been in charge of the advanced laboratory program in chemistry for the last three years. She is academic advisor for the junior and senior chemistry majors. She is also a young homemaker and mother and is approximately the same age as many of her returning students. The chairperson of the Chemistry Department is Sister Mary Leo Bryan (Ph.D.) who has been at Rosemont for nearly 20 years, the last six as department chairwoman. She has a history of pursuing and receiving grants for innovative chemistry teaching and appears to provide a very well-balanced mixture of humane and concerned cleric with an accomplished and savvy professional approach. Other participants were male and female faculty members who taught upper division undergraduate classes and have a history of interest in the returning student and in women students in general. The consultants were selected by the participating companies and included people with the normal variety of attitudes toward the project and toward women in science.

5. Primary Outcomes

a. Experimental outcomes. Complete data from the project are not yet available for analysis. However, the Interim Report of the project director provides a discussion of two of the three project goals: participant satisfaction and employer satisfaction.

In order to evaluate the participants' satisfaction, a questionnaire was given to each of the four women at the completion of her program.at the end of the first year. The purpose was to find out whether they felt the program was an effective means of increasing their skills and knowledge, and also to elicit suggestions for modifying the program in the future. All the replies to date show genuine satisfaction with the opportunities provided. They also offer some practical and constructive suggestions, e.g., providing more organic chemistry review in preparation for biochemistry lectures.

The six-week, paid internship period proved to be highly successful. It is seen as an even more necessary part of the program now than at project inception. Not only does the internship acquaint the participating companies with the capabilities of the participant, but, more importantly, it provides the women with a sense of confidence they can acquire in no other way. The internship supervisors were asked to return a questionnaire. They all reported that the women were adequately trained and well motivated. As expected, there were some differences in performance, but in no case was performance reported as less than adequate. In several instances the supervisors pointed out the above-average willingness of the women to assume responsibility and ability to work independently.

An additional measure of employer satisfaction is the high retention rate of companies supporting the program. In addition to first year support, local companies which might employ chemists were sent letters describing the Rosemont program, asking them to consider the women for employment, and also inviting them to join as cooperating companies. As a result, for the coming year, three additional companies have agreed to provide seminar speakers and internships, and several others have offered to provide tours of their facilities and speakers. These new offers are all the more significant and encouraging, since at this time most companies are reluctant to commit themselves to offering more than one internship.

b. Participant impact survey. Impact questionnaires were sent to 11 participants of Rosemont's experimental program; eight (73 percent) completed questionnaires were returned.

Because of the unique nature of the Rosemont program in relation to the other experimental programs being examined, the first three questions of the impact form did not result in a great deal of useful information for the purposes of evaluation. This program was designed for women who had already earned a bachelor's degree in chemistry, thus these questions are not very relevant to Rosemont's program participants. The answers to these questions did indicate, however, that all of the program participants returning questionnaires were planning to enter or reenter careers in science and that two (25 percent) were planning different careers as a result of the program.

Seven of the eight (88 percent) responding participants cited their opportunity to update old knowledge and learning new developments in their field among the positive aspects of the experimental project. Also cited as positive aspects of the project were the encouragement and confidence to reenter a career (63 percent) and the internship arranged by the college, which also gave them additional confidence in their abilities (38 percent).

The comments received on the less influential aspects of the program were quite varied; they included "Lack of practical help in job-hunting; lack of knowledge of employment problems on the part of instructors;" "Work was optional and not required, therefore various amounts accomplished;" "More emphasis on organic chemistry--theory and aspects;" "All women in the program were not on the same level in background academically, making progress slower;" and "All aspects of the program were important, but the Industrial Seminar was the least--but still very helpful."

c. Site visit. The evaluation team visited Rosemont College, a small, primarily residential, women's college of approximately 600 students, during the fall of 1975. The Chemistry Department is small with a staff of three to three and one-half full-time equivalent professors. When the brochure-announcement of the NSF program was received, the department was already trying to interest local industry in a project very similar to the one conducted.

After a brief discussion of the purpose of the visit and the scheduling of the day's activities, the evaluation team was invited to sit in on an early morning student seminar. An analytic chemist from one of the participating industries was lecturing to the seven-member class on the organization and typical work problems of a petroleum company. The speaker (male) referred to chemists in general as "he" and "him" which was noted immediately by smiles and turned heads by all seven students. The women seemed interested in the technical portion of the presentation and three or four stayed after class to ask questions.

Following the class session the evaluation team met and interviewed a female research biochemist who had been with one of the participating companies for over 30 years, had only a B.A. degree, and considered her tenure and position with the company to be a significant achievement, for a woman. The company for which she worked took on two interns during the first year and hired one of these afterwards on a part-time permanent basis. The Philadelphia job market, at the time of the visit, was very poor with an 11 percent unemployment rate and the oil industry, a prime employer of chemistry graduates in the region, was doing little hiring. In addition to taking interns and assigning a liaison to the project (one-half of the biochemist's time was donated to the project), the company also put on several seminars for the students. A certain amount of propagandizing occurred in the seminars as well as in the interviews; however, the students (and the evaluators) were sufficiently sophisticated to understand what was happening. The internships and seminars, in general, were considered to be an opportunity for a certain amount of public relations. They were said to "convert ecologists and socialists to the petroleum company's point of view and to change the image of the company to that of one participating in the common good." When asked about the relative importance of the project as it contributes to both self confidence and technical skills, the consultant replied that they were equally valuable, with the classroom work contributing primarily to skills and knowledge needed to work effectively with new processes and new equipment, and the internship provided the confidence the women need to perform effectively in a job. This view was generally accepted by the students and instructors as well.

The evaluators then met with four graduates of the program who made the trip to Rosemont expressly for the interview. Each had a slightly different reason for being in the program with needs running from economic to emotional; however, they all expressed satisfaction with every aspect of the program except for the uncertainty of job placement. The two days a week class schedule was appreciated by the women as something they could handle while the family became acclimated to a working mother. They knew they needed the additional training and the special circumstances of a supportive program to risk the commitment. The internship, paying $5.00 an hour, was important for offsetting tuition costs. Supervisors and co-workers were said to be very helpful. Two were still completing internships and were concerned about being able to find jobs. One factor that appeared to be missing in the program was more help in the area of job readiness as reflected in more personal areas: provisions for child care, knowledge of how to present one's self for employment, understanding employer needs, etc. However, as one woman expressed it when asked what she intended to do when her internship expired, "I'll look for a job as quickly as I can knowing I can be productive and valuable to industry and to myself." All four women spoke of a colleague in the program who was now working at Temple University Hospital successfully managing a laboratory there. Almost as an aside, one added, "Her husband is a physician at Temple and arranged for her interview."

The last interview of the day was with a young male visiting professor (from Villanova, with whom Rosemont has close ties) who was teaching an undergraduate class which included seven women from the program. He said his other undergraduates were much more well prepared for his course than the program women and he saw a definite difference in ability; however, the participating students worked hard and were expected to do well. In his opinion they would be "devastated" if thrown into an upper division chemistry class at a university without each other and the special help they received.

6. Secondary Outcomes

There was no discernable impact on the institution, already committed to the education of young women, except as the program strengthened the Chemistry Department. The additional few students enrolled enabled the department to have one additional faculty member who brought specialized knowledge to the department for the benefit of all. The program was said to also be beneficial to the undergraduates in the department for this reason, and also to other students who took some pride in the efforts of the returning women. The existence of the program also sparked the enthusiasm and interest of the entire department faculty which in turn affected all students. Families of the women interviewed reacted in different ways with attitudes ranging from support and pride to modest resentment. The employers, supervisors, and co-workers of the interns were said to be impressed by the competence, motivation and ability of the women chemists. The increased sense of worth the women expressed about themselves is almost certain to have additional effects unless the employment picture is so grim that disillusionment sets in to replace the glow of achievement.

7. Materials and Dissemination

No special materials were prepared for this project. A self-paced programmed text, already in use at Rosemont was effective in the introductory portion of the course. As far as we know the program has not yet been publicized to other institutions except through NSF and DRI channels.

8. Project Costs

The total cost of the program was almost $50,000 for the three-year period, including the cost of eight scholarships for which Rosemont hopes to be able to secure matching funds. The NSF share was $38,058, making the cost (assuming 12 completions) $3,200 per participant, a rather expensive program. However, students are expected to pay tuition and when their tuition is computed as income, the costs are just about offset. Administration costs would be high if the additional counseling and tutoring time and internal evaluation time were all calculated. Getting industrial support, advertising the program and providing job counseling and job placement services would probably cost in the neighborhood of $800 per participant, even with an increase in the number of students.

9. Conclusions and Recommendations

1. Updating technical skills for science graduates who

have been out of school for a number of years is essential for even the most entry level positions.

2. The all-women classes with groups of mature women together are important for this age group.

3. The two day a week scheduling is helpful in attracting students and bridging the period between home and work.

4. The seminars were more important when conducted as help sessions than as information sessions as they were originally intended.

5. The internships were invaluable because of the experience and the income they provided.

6. The women needed more assistance in complementary aspects of job preparation. Perhaps selection of under-employed women (working in sales or offices) instead of all unemployed women as participants would have increased the program's success.

7. Project data collection was unsystematic and a great deal of the information was anecdotal and from memory. No provision for follow-up of long-term effects was apparent. Special forms for data keeping purposes supplied to the project directors would have been helpful for pre-, during, and post-intervention data.

8. Funding this type of project in an area where the unemployment rate is high and likely employers are laying off workers can result in dual problems of (1) disappointment to candidates and (2) backlash among other workers. A job market analysis should probably precede the initiation of projects where there is expectation for immediate employment.

G. "Recruiting Women to Engineering Careers"
University of Oklahoma, Norman, Oklahoma 73069
Project Amount: $10,912*
Project Director: R. Leon Leonard, School of Aerospace, Mechanical, and Nuclear Engineering
Educational Level: Secondary School

1. Proposed Project

The project was proposed to test the hypothesis that even a brief (one-week long) experience at engineering school for high school women would provide more information and stimulate more interest in an engineering career than a more traditional deluge mailing. The residential seven-day program was designed to present 50 young high school women with an understanding of what they might do as practicing engineers and as engineering students. The program planned to include presentations by practicing women engineers, discussions, tours, and experimental demonstrations by the various academic departments of the College of Engineering, as well as participation in a "hands-on" engineering project. There was no cost to the participants other than a $15 application fee and the expense of transportation to and from Norman.

The participants were to be selected from those who had completed at least their sophomore year in high school and who had diverse geographical and socioeconomic backgrounds (in order to both attract a cross section of women into engineering and to test the generalizability of the results of the planned intervention). Media publicity and a follow-up program were expected to aid in spreading the influence of the program. The accompanying recruiting effort was expected to serve as a focus of interest for the women currently enrolled in engineering at the University. By serving in the recruitment and follow-up, and as project leaders during the residential program itself, it was theorized that their own interest and enthusiasm would be strengthened. No methods for evaluating the extent to which this reinforcement occurred were proposed.

Evaluation measures were proposed for the participants and for a control group composed of girls who applied for but did not attend the program. Questionnaires were to be used to estimate the impact of the program on career choices as well as on attitudes toward and knowledge about engineering. The evaluation was also expected to measure the attitudes and knowledge of teachers and parents.

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*Plus matched funds from Shell Oil Company.

2. Implemented Project

During the week of June 2 through June 7, 1974, the College of Engineering conducted a residential orientation program for 41 high school women to introduce them to engineering as a possible career choice. The project was divided into phases: Phase I--recruitment; Phase II--the one-week program; and Phase III--the evaluation and folow-up study. Phase II of the project, the actual week long program, was conducted as proposed and consisted of four kinds of activities: The percentage of time in each activity is as follows:

speakers	16%
tours and experiments	20
engineering projects	24
university experience	29
miscellaneous	11

The tours and experiments were short duration visits (one hour each) to engineering facilities and laboratories on campus and in the community. Their purpose was to acquaint the participants with the hardware and facilities required to carry out engineering tasks, and to show them activities which were being conducted on the campus extending the state-of-the-art in engineering. These program activities relied upon the voluntary participation of the personnel involved in the facilities. This presented a problem in some cases because the volunteers were sometimes not able to relate to young women, and hence the participants lost interest in what was said or done. The most successful tours and experiments were those where the women had an opportunity to put hands on the equipment and work with it.

The "University experience" was the part of the program which attempted to introduce the participants to life at the University, and to a community experience with other women who had common interests in a field unusual for women. It was hard to estimate the actual amount of time which the participants spent involved in activities within this category, because to a great extent, even discussions into the night with roommates qualify. One of the difficulties with the program as it was carried out, is that part of the University experience was with young men who were on campus for the summer term. The sense of life at the University was certainly reinforced by those experiences, but the development of a community experience with young women who shared unusual interests in science or engineering often took a secondary place.

The participants were separated into four groups on the first morning of the conference for work on engineering projects. The participants stayed in the same project for the entire week so the engineering project was the most concentrated and in-depth activity of the week. The four projects were titled Water Quality, Air Quality, Building Energy Conservation, and Vehicle Aerodynamics. In each of these subject areas the participants learned about a problem, proposed a solution, analyzed the solution, took experimental data, drew conclusions, and presented their results to the rest of the audience.

The experimental design of the implemented project was considerably changed due to the lack of sufficient numbers of qualified applicants. A control group, originally intended to be drawn from the excess number of applicants had to be generated by additional contacts and mailings and attempts were made to match the resulting control group to the 41 participants in terms of class standing, grade point average, family income, and demographic data. Since the selection of the control group was not complete until many months after the summer program, all the pre-measures proposed for the control group were lost. Thus, changes in attitude attributed to time and maturity could not be estimated.

No pre-measures were collected for the participants, presumably because of difficulties with the experimental design due to the insufficient number of applicants and subsequent difficulty with identifying control subjects. Although there are difficulties with pre-post comparisons in the absence of controls, the pre-post comparisons would have probably generated more reliable information than post tests alone from experimental and control groups that were not matched on several significant factors such as education of mother and mother's profession.

Also omitted from the experimental design were the data collection and analysis procedures proposed for measures from high school teachers relating to attitudes toward careers in science for women. These were to have been collected just prior to the summer program and again one month after the program. There is also no evidence that proposed plans for collecting parent reactions were ever instrumented.

Recruitment

The engineering orientation program was called Summer in Engineering for Women (SEW), a perturbation of the letters SWE (Society of Women Engineers), a chapter of which was recently formed on the OU campus. This was the second year of a program of this sort for high school women. Consequently, for publicity and recruiting for the program, they called on contacts made the previous year for the preceding program. In this regard, program publicity was sent to the residential counselors from the previous program, to teachers or counselors who had recommended the previous program to its participants, and to the participants themselves, 25 in all. In addition, a mailing was made to Oklahoma high school counselors and advisors, to mathematics and science teachers in Oklahoma City and Tulsa (the two largest cities in the state), and to local organizers in the Oklahoma

Engineering and Technical Guidance Council (OETGC), a recruiting group sponsored by the engineering societies in the state. The mailing included a letter inviting the recipient to recommend women for the program and two brochures and application forms to be given to prospective participants. Two thousand copies of the brochure were made for the program. The brochure for the second summer's program included pictures from the first program, and indicated visually what the program involved.

In addition to the mailings a news release describing the program and inviting applications was prepared and sent to all of the daily newspapers in the state. Mention of the program was also made in a newsletter sent by the Aerospace, Mechanical and Nuclear Engineering school at OU to high school teachers throughout the state.

The application form included a request for the name of a reference, usually the teacher or counselor who suggested the program to the applicant. When the application was received, a reference form was sent to this person asking for information on the applicant's courses taken, grades and personality traits. This information was used in assigning the participants to their engineering project groups, and had originally been intended to be useful in selecting participants from among the applicants. As it turned out, there were fewer applicants than spaces available, so no selection was made; all the women of the proper age group were chosen.

Of the women who participated in the program, two had completed high school, 20 had completed their junior year, 18 had completed the sophomore year, and one had only completed her freshman year.

3. Obstacles to Implementation

The program was conducted as planned. The experimental design for estimating program impact, however, was seriously disrupted by the inability to generate a sufficient number of applicants to proceed with the design as planned. For the 41 girls (instead of 50) who participated in the program, the exposure, the information, and the opportunities were as planned and the project appears to have accomplished those objectives of delivering experience and information. As part of a program to estimate the value of different types of interventions, the opportunities to collect reliable measures on the impacts to girls, teachers, and parents were either reduced considerably or lost entirely. The efforts expended to plan for and identify a control group of similar background to the participants appears to have severely diluted the overall experimental design.

4. Project Personnel

The project supervisor was Dr. R. Leon Leonard, Assistant Professor of Aerospace, Mechanical and Nuclear Engineering at the

University of Oklahoma since 1971. His professional experience includes both full time and summer consulting work as a practicing engineer in fluid mechanics and laser technology. He has numerous publications in these fields. He has also been active in programs for women on the OU campus. His motivation at least in part has been concern over dwindling enrollment in engineering, but he appears to be committed toward encouraging women to pursue career options as a principal.

The proposed associate, Dr. Jeffrey G. Witwer, had conducted the 1973 womens program at OU with Dr. Leonard. Mr. Jay Fein (Department of Meteorology) and Mr. James Freim (School of Aerospace, Mechanical and Nuclear Engineering) were the actual project associates. Ms. Sara Fein (Department of Sociology) was a consultant to the project in the area of experimental design and evaluation.

The speakers who made presentations to the program were practicing women engineers who talked about their experiences in engineering and in becoming engineers. They also discussed why they had chosen engineering as well as other aspects of their lives. The speakers included Ms. LeEarl Bryant, an electrical engineer with Collins Radio in Dallas and chairperson for student activities of the Society of Women Engineers; Ms. Gwendolyn Albert, a civil engineer with the Environmental Protection Agency in Houston and recently named a White House Fellow for 1975; Dr. Elene Leonard, a nuclear engineer with the Los Alamos Scientific Research Laboratory; Ms. Naomi McAfee, President of the Society of Women Engineers; Ms. Nancy Cole, a metallurgical engineer with Oak Ridge National Laboratory; and Dr. Peggy LeMone, a meteorologist with the National Center for Atmospheric Research in Boulder, Colorado. In addition to the information they provided to the participants about engineering, these women also served as role models to whom the girls could relate.

5. Primary Outcomes

A. Experimental outcomes. The University of Oklahoma project was designed and proposed as an experiment to test the effectiveness of a summer residential engineering information program for increasing the number of females enrolling in engineering. The basic premise of the project was that some high school women with aptitudes for engineering do not pursue engineering as a career because of the absence of information about the nature of an engineering career. Although the assumption is reasonable, and the program appears to have been well thought out and rated successful by the participants, neither the assumption nor the intervention was ever evaluated experimentally.

The first problem was, of course, that the anticipated control group did not materialize. The development of a control replacement group was therefore conducted during the time period and with the resources planned for pre-experimental data collection from students and high school teachers, nor was post-experimental data from parents, also in the proposed experimental design, collected and reported upon.

Questionnaires were mailed six months after the program to the participants and control group. Although the two groups were similar on a number of measures relating to their grade point averages and various demographic variables, they were dissimilar on measures relating to mother's education and work status, both of which have been shown to relate to higher career aspirations among women. Had pre-intervention measures been collected the effects of the dissimilarities could have been controlled in a number of ways. The differences in attitudes and in articulated plans for majoring in engineering, indicated that 30 percent control women and 52 percent experimental women planned to pursue engineering majors.* These figures, although encouraging, do not clearly indicate a cause and effect relationship.

B. Participant impact survey. A total of 42 impact questionnaires were sent to participants of the University of Oklahoma experimental program. Fifteen (36 percent) were returned completed.

Of the 15 participants returning the questionnaire, 12 (80 percent) were taking a math or science course; one of those reported taking the course as a result of the program, while the other 11 participants taking a course indicated they would have whether they had participated in the program or not.

Eleven of the 15 respondents (73 percent) indicated they were planning a career in math or science. One of the 11 respondents (9 percent) stating she had chosen a career in math or science traced her career choice to her experience in the program; the remaining ten said they would have chosen such a career with or without the program. However, five respondents (33 percent) indicated they were planning on a different career as a result of the program; four of the five planning a different career were going into math or science fields, while one of these respondents was planning a career in another field as a result of the program.

Among the comments on the positive aspects of the program, the most frequently cited was the information gained about the different types of engineering and engineering careers (53 percent). Also cited were the varied experiences and projects of the program (33 percent). Other positive comments included "person to person contact with women engineers," and "the faculty and organization."

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*This high percentage in both cases can be in part attributed to pre-selection biases and the way in which the question regarding engineering in the absence of other stated choices was posed.

The negative comments about the program were quite varied. Twenty percent of the respondents stated they thought the program was excellent and had no complaints. The most frequently cited negative comments were that the lectures were poor (13 percent), that the program was not broad enough in scope (13 percent), and that the program was not long enough (13 percent). Other negative comments included: "atmosphere," "I think the program should be enlarged to include freshmen and sophomore girls also so they can start preparing with more math and science in high school," and a comment derogatory to appearance and mannerisms of one of the role models.

6. Secondary Outcomes

Almost no data were reported on the effects of the program on counselors, teachers, and parents although these secondary outcome measures were proposed for collection and analysis.

The effects of the NSF sponsored project on the institution, however, can be inferred from the 1976 paper given by the project principals to the ASEE 11th Annual Midwest Regional Conference held in Norman on March 26. The project appears to have strengthened the OU institutional commitment for and ability to conduct similar activities. The recruitment procedures described for their 1975 program (including a mailing to mathematics teachers throughout the state) reflects what was learned during the 1974 experience. The 1975 group was smaller, reportedly in order to keep the individual project groups to six or seven students rather than the ten student average in 1974. Also, the establishment of two women in primary faculty roles throughout the week (OU still does not have full-time women engineering faculty) was said to increase the opportunities for female role model identification, and having the faculty staying in the dormitory with the participants enabled the establishment of closer relationships, also presumed to be desirable. In 1975, no attempt was made to conduct or evaluate the week as an experiment, but a pre- and post-questionnaire to the group relating to their selection of college majors indicated, first of all, that eight decisions were changed on the basis of the information and exposure (which in itself is a desirable outcome) and further that six of the eight changed decisions were in favor of engineering. The 1975 program is described here as an indicator of the impact of the NSF funded project on the institution to provide more and better services to encourage women to enter scientific programs. Conversations with Dr. Leonard, the project director, indicates a continuing commitment and the tracking of long-term effects showing an increase in female enrollment at OU that is higher than the increase experienced at other state institutions. Since geographic location and city size does not vary significantly among the state schools, the reputation of the institution as one that encourages and supports female enrollments is given as a probable cause of this phenomenon.

7. Materials and Dissemination

Except for the announcement/brochure sent to the candidates in advance of the program, no special materials were prepared or disseminated. Results of the project were reported, together with results of the 1973 and 1975 summer programs, in a paper described in Section 5 of this report. This paper appears to constitute the formal dissemination.

8. Costs

The actual cost per student is estimated from the NSF project budget and the matching funds to be approximately $500 per student, with a group size of 41. These expenses include preparation for the seminar and for the evaluation, recruitment costs, delivery services (teachers and consultants) and one week residential costs for students and consultants. Replication costs would depend upon the number of students involved, but should preparation and evaluation time be reduced and publicity/recruitment procedures routinized and made increasingly more effective (because of the network of satisfied participants) then the cost could conceivably be reduced to about $300 per participant.

9. Conclusions and Recommendations

1. As an alternative to deluge mailing or high school career day talks, the week long seminar was probably effective in providing information and encouragement to the young women involved. The cost per participant, however, is high and as a routine program without private assistance, the cost/benefit analysis would probably not result in a recommendation for continuation. As long as institutions and private industry are willing to share costs, the program is a desirable and worthwhile activity and appears to be improving with sucessive repititions.

2. Recruitment procedures appear to require improvement. For one thing, minority participation, although proposed, did not materialize and the participants were exclusively white middle class. Although the high ability and highly motivated youngsters are more easily identified from within this group, no efforts were observed to broaden this participation.

3. The $15 application fee, certainly modest enough for the week long residential program, may have been a problem since it was not at all clear that all applicants would be accepted. A $5 processing fee to ensure geniune interest plus a $10 registration fee, or simply the promise of returning the $15 to unsuccessful applicants may have been more satisfactory. As observed by one participant, the routine inclusion of freshmen and sophomores would ensure more opportunities for selection of the appropriate college preparation classes.

4. From the responses to the lectures and to the hands on projects, it seems clear that succeeding seminars should minimize the former and continue to strengthen the latter. Of particular interest is the observation that most of the participants appreciated the career information provided as being the major strength of the program, even though they enjoyed other more unique aspects of their experience.

5. We recommend special attention to control group procedures in projects designed to provide an informational base for future programs. That is, many of the projects share OU's difficulty in obtaining an adequate comparison group; consequently, no definite conclusions can be reached. We would encourage an emphasis on evaluation rather than implementation in these R&D projects; e.g., the appropriate controls should be retained even if it reduces the number actually participating in the treatment.

H. "Research Introduction to a Scientific Education"
Goucher College, Townson, Maryland 21204
Project Amount: $69,581
Project Director: Barbara Long, Department of Psychology
Educational Level: Secondary

1. Proposed Project

Project RISE tested the hypothesis that women high school students who are involved in meaningful college level scientific problem-solving activity will develop greater interest in and more favorable attitudes toward scientific careers than their classmates who do not have such an experience. This hypothesis was derived from research and theory in social psychology which indicates that participation, role-playing, and public commitment are effective agents of attitude change. Social facilitation, social reinforcement, and identification with attractive and powerful models are believed to be the social processes that operate in the experimental treatment in order to promote changes in the experimental subjects.

Subjects were to be selected at random among those female high school juniors who scored at or above the 75th percentile in grade level standardized achievement tests on the basis of national norms and were to be assigned at random to three groups, each of about 60 subjects. The experimental group and two control groups were to be tested initially with four different instruments. The experimental group was then to undergo the experimental treatment, which was to consist of a free four-credit course at Goucher College. The course was designed to be an interdisciplinary introduction to scientific research, and was to involve the student in designing, carrying out, and evaluating an independent research project.

At the end of the course, the experimental group and both control groups were to be tested with the same instruments used as in the initial testing. It was expected that the experimental and first control group would not differ in the initial testing, but that in the final testing the experimental group would be higher in interest in and attitude toward scientific careers than it was in the initial testing, and higher than either control group in the final testing. The change in the experimental group from initial to final testing was also expected to be significantly greater than the change for the first control group. A longitudinal follow-up consisting of a questionnaire about career plans was expected to be carried out in the spring of 1978.

2. Implemented Project

There were no changes in the rationale of the implemented project.

There were, however, several procedural changes. The major change was in subject selection. It was anticipated that all the women would be in at least the 75th percentile in grade level standardized achievement measures. However, such scores were not available. Consequently, the principal and guidance departments were asked to recommend those junior girls highest in ability. A total of 479 students were selected from four upper middle class schools. It was also decided to assign grades to the course.

The project proceeded on schedule, and as planned. In early fall, 331 students were tested, and were invited to take the experimental course. About 140 said they were interested in the course and 68 were invited to participate. The first control group (n=69) were sent a letter expressing regret for exclusion, and saying that they would be retested in the spring.

The course was divided into two sections. One section was held on Thursday and one was held on Saturday. Classes in biology and psychology were held both days, while mathematics and history were held on Thursday and chemistry and economics were held on Saturday. Each meeting was two hours. The students first heard a one-hour lecture and discussion of each topic area and were asked to list their first three choices of discipline. All students were assigned to either their first or second courses. The course proceeded, with vacation breaks, from October to April (a total of 15 sessions).

Recruitment and sampling. The project was sucessful in obtaining the desired number of participants, working in cooperation with the local public high schools. First, the cooperation of the school system was obtained, and the subjects were selected by the school. A letter was sent by Dr. Long to both the students and their parents at their home address notifying them of the first meeting (the testing section) where the study would be explained. They were asked to send a letter to the principal if they did not wish to participate. It is interesting to note that the initial letter did not mention that a free four-credit course would be offered. The students were told about the course at the testing section, and were asked to obtain their parents' signature if they wished to participate.

The project also reported a good completion rate (85 percent), and some of the instructors commented on the diligent attendance.

3. Obstacles to Implementation

The interim report detailed several practical problems in conducting the project. The first was the problems involved in providing transportation for the students, including arranging for and scheduling the tranportation. The second was also a logistical problem, that of having all 68 women meet together in the first session, providing little chance for faculty-student interaction. The problems in obtaining information on the ability of the sample have already been noted.

4. Project Personnel

All of the eight faculty members conducting the sessions were regular faculty except two who were working on their dissertations. The faculty conducting the Thursday session were all women and the faculty in the Saturday session were three men and one woman. There were four female teaching assistants. The faculty members were visited by a member of the DRI staff at the end of the course. All eight seemed competent and well versed in their fields, but none appeared to be enthusiastic about the course at the time of the visit. The effect of their attitudes on the students could not be determined. However, the participant impact statement by the students, completed four months after the site visit, contained many positive comments about the faculty. The Goucher interim report also contains many positive comments about the instructors reported to the project personnel by the participants.

5. Primary Outcomes

A. Experimental outcomes. The statistical analysis of the scores was generally complete, and appropriate, along with an adequate experimental design. Consequently, it is ironic that it is one of the few experimental projects to show statistically significant results--but in the opposite direction than expected.

First, there were many significant differences between those wanting to take the course and those not desiring it. About one-half of the 68 variables analyzed by t tests showed a difference. Generally, those interested in the course were interested in careers in science.

The second finding was a positive significant correlation between the student's rating of enjoyment of the course and the grade received ($r = +.63$). Further, prior interest in science as a career also correlated with both grades ($r = +.39$) and ratings of enjoyment ($r = +.31$). There is also some indication that there is a correlation between grades and the intention to take further courses in the discipline taken during the RISE project.

Several analyses of variance for repeated measures computations were taken for the control and experimental groups. A significant effect of repeated trials was found, with the scores for the science factor being lower after the course. Several other factors (helping people, creative arts, traditional roles) were higher for the experimental group in the second testing.

The analysis also showed that while scientific occupations were rated higher on the initial testing than nonscientific occupations, the ratings for the scientific occupations dropped for the experimental group, but increased for the control group. However, another control group, tested only at the time of the terminal testing, showed the lowest ratings of the scientific occupations. Further, the analysis showed that both the experimental and control groups declined slightly in ratings of their own career plans for scientific relevance. Again, however, the control group tested at the end of the year scored the lowest. This was accompanied by a decline in both groups for the eight scientific occupational interest scores on the Strong Vocational Interest Blank.

Because the group tested only at the end of the project was generally lower in scientific interest ratings whether measured by ratings in terms of personal interest, the semantic differential, the open ended questions on the Strong Vocational Interest Blank, its usefulness was obviated as a control group. This difference is not surprising since the experimental group and the first control had already expressed an interest in careers in science, by desiring to take the experimental course. The group tested only at the end had not expressed such an interest. The mean scores, however, may also be compounded by a time variable, where females typically show increased desirability of traditionally male roles over those years (e.g., Long, Zellar and Henderson, 1968).

B. Participant impact survey. Sixty-two questionnaires were sent to participants of Goucher College's Project RISE; 36 (58 percent) completed questionnaires were returned.

Of the participants returning questionnaires, 28 (78 percent) were taking a math or science course. Twenty-six (93 percent) of those taking a math or science course would have taken it with or without their exposure to the experimental program, while two were taking the course as a result of the program.

Twenty-one (58 percent) of the participants returning questionnaires reported that they were planning a career in math or science. Eighteen (86 percent) of those indicated they would have with or without the program, while three (14 percent) reported that their math or science career choice was a result of the experimental project and 34 (94 percent) of the participants returning questionnaires indicated no change in their career plans after the project, and one participant was still undecided as to her career plans.

On the whole, the students were quite positive about the project, although the most positive reponses appeared to be from those taking the math section.

The most frequently cited positive aspects of Project RISE were the instruction and opportunity to participate in research (50 percent), the exposure to a college atmosphere (44 percent), and the college credit given for participation in the program (14 percent). Other comments on the positive aspects of Project RISE included "lots of resource materials," "I was interested in biology for awhile. The project gave a good introduction of what continuing in biology would be like. We were treated as college students." "I studied something I couldn't have otherwise at the time. Gave me idea in which direction to head." "Giving you an opportunity to try out a particular field, gave you experience for any type of research and helped you learn to be organized."

When asked to state the less influential aspects of the program, eight (17 percent) replied with either positive remarks or "none." Other frequently cited less influential aspects were that there was not enough information provided (22 percent), that the program was not oriented toward the participants' needs or the participant misunderstood the purpose of the program (14 percent), that the instruction was not on the students' level of understanding (11 percent), that the participants desired more diversity in program content (11 percent), and that they would have liked to take more courses (8 percent). Other comments included "We really never learned anything once we went into the field we wanted." "I found the program tedious and somewhat boring because it took too many weeks until something constructive was accomplished." "It was a lot of work with all my other school work. The time it was held was inconvenient." "The long hours. Too much unsupervised time on unclear projects." "Not everyone in my group was as enthusiastic about the project as I was and this placed a damper on the project as a whole."

In sum, the students reported being most impressed by the exposure to a college atmosphere, and a better understanding of what would be expected of them when they attended college.

C. Site visit. The site visit was made to the Goucher campus in October following completion of the project. Goucher is a small private women's college, set in a beautiful location outside Baltimore.

Most of the project personnel and a few of the participants were interviewed during the visit.

The participants were varied in their response to the course. On the whole, they were quite positive, but none of them reported an increased interest in science. They reported the problems noted elsewhere in the report: the pressure by parents to take and complete the course, their scheduling problems, their frustrations with the workload, and their lack of comprehension of the elements and purposes of basic research. At the time of the visit, many of the participants appeared to be quite traditional in their plans for the future.

Most of the faculty involved in the project were interviewed. Most of them had some reservations about the project. The most frequent comment was the absence of ability and/or motivation in some of the students. The faculty had put a great deal of time in the course preparation, but were unsure how much they had conveyed to the students. Some of the faculty members involved did not appear to be the role models most frequently described by young women as those they would like to emulate.

The most positive effect of the project appeared to be on the teaching assistants. Although they, too, had reservations about the students' ability to complete the assignments, the project appeared to have increased their awareness and interest in their own careers.

6. Secondary Outcomes

There appeared to be several secondary benefits both to the college and to the students.

One of the reasons for applying for the grant funds was to increase the visibility of Goucher in the community and to make it known to a group of potential students. It was apparently successful in this goal since at least two of the women in Project RISE were subsequently early admission students at Goucher. The institution also benefited by acquiring some scientific equipment for their laboratories.

About half of the faculty at the college (and half on the project) are male. The influence of the project on increasing both the male and female faculty member's awareness of opportunities for women in science-related careers could not be determined. The project director, however, reported an increased awareness by the faculty in the capability of conducting research/demonstration projects.

The secondary benefits to the students included the four-credit course, the enhanced potential for college attendance, and the advanced preparation of what would likely be expected of them on their entrance to college.

7. Materials and Dissemination

A. Course materials. An incomplete outline of the two psychology sections, two biology sections, chemistry, economics, and history sections of the subject matter was given in Goucher's first interim report. A short synopsis of each course is contained in the final report. These materials are not adequate for transportation and reuse on other campuses in their present form, e.g., development of similar courses would still require a great deal of preparation time on the part of the faculty. However, since the courses focused on research, "reuse" of identical problems is inappropriate. Further, it seems likely that the most successful courses would be taught in the area in which the instructor is best versed and most enthusiastic. Consequently, it may be wise to have the range of topics defined by the interests and areas of expertise of the instructor.

B. Testing materials. A complete compendium (except the Strong Vocational Interest Blank) was contained in the Appendices to the first interim report. These scales included ratings of 30 occupations for personal interest, ratings of ten occupations on eight bipolar adjectives, and an open ended questionnaire about career plans. The test-retest reliability of the 30 ratings, the ten semantic, and the 27 SVIB for women are all reported.

The evaluation team is unaware of any dissemination activities.

8. Project Cost

The budget for this project was $69,581 to the Foundation. The contribution by Goucher was $4,000, bringing the total to $73,581. The original cost per participant then was about $1,100. Most of these costs would be approximately the same for repeated implementation of the design, e.g., faculty time was not fully reimbursed on the current project, especially for preparation time, student assistants would still be needed, and so on. Only the testing time and data analysis time would reduce the budget. Further, the bulk of the time of this project was spent in activities directly related to classroom activities. Finally, several of the faculty felt the project would be more successful with a smaller student-to-faculty ratio. Consequently about $1,000 per participant appears to be an appropriate estimate for reuse of the project model.

9. Conclusions and Recommendations

Some of the recommendations given below are derived from project personnel, while some are the opinions of the DRI team.

1. Because of the significant, although perhaps temporary, decrease of interest in science, it is recommended that this format not be reused unless alterations are made.

2. This format might be used more effectively with higher ability women. This recommendation, given in the Goucher report, is in part due to the fact that there was a

positive correlation shown between the grades in the course and their ratings of the project. Further, both comments from the participants reported in the project report and interviews with the DRI team, some of the young women failed to grasp the concept of "research," and the work appeared to be beyond their ability.

3. A more flexible and concentrated schedule might be used. The final report noted that the one week interval period appeared too long to keep sustained interest on the part of the young women. The two hour period did not allow sufficient work to be done by the instructor and teaching assistants. For example, in the biology experiments, recordings on the crabs had to be made everyday. Consequently, the students could not participate in all phases of the research.

4. Highly motivated students might be used exclusively. Although most of the students were somewhat interested in science, there was some indication that the students were encouraged by their parents to attend because it offered four college credit units for free. Consequently, both the girls and the parents in the upper middle class community saw the program as a practical matter. In some circumstances, incentives, when they serve to draw inappropriate populations, may not be advisable.

5. Basic research courses may not be the most appropriate for high school women. This recommendation comes from the large number of comments from the participants regarding lack of structure, unsupervised time, a classroom atmosphere and general lack of understanding about "research." Research, even under the best of circumstances can be painstaking, time consuming, and tedious. Very possibly, only with an extensive background in the area, does it become fascinating and worthwhile. Consequently, it is important that students pick their own topic areas, or have some "structure" to their investigations. In sum, "real" research may be conducted with more satisfaction with substantial background knowledge and real interest.

6. This format might be more effective with college students. While accelerated academic courses have a long history in educational/motivational interventions, the research-oriented courses might be most advantegeous with juniors and seniors in college in the area of their majors. That is, in college, there is still typically an absence of opportunity and encouragement for women to conduct

independent research. Both from talking to the teaching assistants in this project, and talking to mature women scientists, research experience in late college years was an important factor in pursuing their major field of study. By this time, adequate preparation has taken place, and research provides a feeling of independence, confidence, and personal satisfaction. Also realistically, the results of sophisticated research during the college years (e.g., resulting publications and more intimate acquaintance with faculty) may be the deciding factor for admittance to graduate school.

7. The project might be more effective if the students had gotten to know each other. As far as the evaluators could ascertain, few of the women made friends with each other during the project. For those interested in pursuing science as a career, friendship with other women may provide some peer support during work for atypical goals.

I. "Measuring and Improving Awareness and Attitudes of Girls Toward Engineering"
Michigan Technological University, Houghton, Michigan 49931
Project Amount: $26,000
Project Director: Clyde E. Work, College of Engineering

1. Proposed Project

The purpose of the project was to explore the level of knowledge and attitudes of eighth grade girls regarding engineering. Specifically, the project was intended to answer the following questions: (1) What level of awareness do eighth grade girls, their parents, teachers and counselors have about the job of an engineer, placement opportunities for an engineer, and opportunities for women in engineering? (2) What attitudes do eighth grade girls, their parents, teachers, and counselors exhibit toward engineering, and women in engineering? (3) What effect will contacts with women engineers, information about engineering and experiences with engineering-related activities have on the awareness of and attitude toward engineering of eighth grade girls from various types of schools? (4) Which method(s) of introducing information about engineering is (are) most cost-effective in improving the awareness and attitude of eighth grade girls toward engineering?

The project was to involve eighth grade girls from three different Michigan schools: one in the sparsely settled Upper Peninsula and one each from the suburbs and inner city of a large metropolitan area. The eighth grade girls in each high school were to be divided into five groups of equal size on a random basis. One group was to receive (1) lectures about engineering, (2) discussion with women engineers, (3) audiovisual, and (4) printed information about engineering; a second group was to (1) perform "hands on" engineering-related projects under the guidance of women engineers, and (2) to receive printed materials about engineering; a third group was to receive printed information about engineering without speakers or projects; a fourth group was to be contacted only through printed information provided to their parents, and a fifth group (controls) was not to be given any special information at all during the experiment.

The changes in awareness and attitudes of these girls with respect to engineering were to be used to measure the influence and cost-effectiveness of different information dissemination methods. The awareness and attitudes of parents, teachers, and counselors were to be surveyed using questions similar to those asked the girls but appropriately worded for their respective roles.

2. Implemented Project

In general, the project went as planned. The study involved students from five different junior high schools in Michigan, about 1,000 girls and 300 boys, mainly eighth graders but with some seventh and ninth graders for comparison purposes. Three schools were involved in the experimental treatments. Two schools were located in a large metropolitan area, one inner city and one suburban, and the third was one of the larger schools from Michigan's sparsely populated Upper Peninsula. In addition, students at two other schools were used as controls and for supplementary tests but were not subject to the program of treatments. This group included both males and females, as well as seventh, eighth, and ninth graders.

The girls at each of the three experimental schools were divided into five groups of equal size for the experimental aspects of the study as seen in Table 1. In two of the schools, assignment to groups was on an alphabetical basis and in the other it was on the basis of homeroom assignment. Students who dropped out or changed schools during the year were omitted from the final comparison.

TABLE 1. TREATMENTS

Group	AV	Lect.	Disc.	Q&A	Lab	Printed Information		
						Girls	Parents	Faculty
A	X	X	X	X		X	X	X
B			X	X	X	X	X	X
C						X	X	X
D							X	X
E								X

Group A treatment (presentations by women engineers). The treatment of Group A at each school started in November with an audiovisual presentation. At the Inner City school which had 100 percent black enrollment, the film "A Piece of the Action" was used. At the other two schools, which had only white students, an adaptation of the slide-tape show "Creating a Better World through Engineering" was used. Several slides in the original set were replaced by others chosen to portray women and minority engineers in addition to white males. The primary treatment for Group A consisted of three live presentations by women engineers. In February, a woman engineering student visited each school, told about her experiences as a student and how she perceived engineering as a career for women. Two different students were involved in these presentations, a black student at the Inner City school and a white student at the other two presentations. The third presentation was in March by a woman practitioner of engineering from industry. The presentations emphasized what engineering is like on the job. The final presentation was made in April by a woman electrical engineering professor, the co-director of this project. She discussed the ways in which a career in engineering can be combined with marriage and a family.

Girls in Group A received printed matter at intervals, usually about a week apart. These items included most of the guidance material available from ECPD, the NSPE piece, two Engineering Manpower Commission bulletins, some SWE material, etc.

Group B treatment (engineering projects). The Group B girls participated in four engineering projects chosen from Civil, Mechanical, Metallurgical, and Electrical Engineering. Each project took one class period, about 55 minutes. The first three projects were administered by undergraduate engineering students, all women except for one. The last project was handled by the woman engineering professor. The goal of the projects was to give the eighth graders a feel for engineering through hands on experience with simple engineering problems and equipment.

Group C. Group C received the same printed materials on engineering as Groups A and B but had no special programs, projects, or contact with the resource persons.

Group D. Group D had no programs, no projects, no discussions, and no printed information. However, their parents did receive the same information as parents of Groups A, B, and C.

Group E. Group E at each school was a control group. Neither the girls in Group E nor their parents received any information as part of the project. They did, however, complete both the initial and final awareness and attitude surveys.

It was not possible to insulate Group E from the girls in the other groups in a project extending over eight months. They were in regular social contact and in various classes together. The controls, therefore, were expected to have received some information and have been influenced to some extent by their peers in other experimental groups. This influence or contamination of controls was expected to be observed as changes in some responses to the awareness and attitude surveys. The same logic, however, applied to each experimental group.

Group E'. To provide a check on this eventuality, additional control Groups E' in two other schools were surveyed at the same times in the fall and spring without any informational program being provided to the students, their parents, teachers, or counselors as a part of this project. Comparison of initial and final survey responses of this group was used to show whatever changes would result from information ordinarily available to junior high students at school, through the public media, and from normal maturation processes.

Parents. Parents of all the experimental girls were asked to respond by mail to the attitude surveys at the beginning and the end of the project. During the course of the project, parents of the girls in Groups A, B, C, and D received at home through the mail essentially the same printed information on engineering that the girls in Groups A, B, and C received at school. Parents of girls in the control Groups E and E' received no information about engineering at any time from project sources.

Only one parent in each family was asked to respond to the survey, the choice of respondent being left to the family. However, the same parent was requested to respond to both the initial and final surveys.

Teachers and counselors. All faculty members involved with eighth grade girls at the three experimental schools were asked to participate in the attitude surveys at the beginning and end of the project and each one received a set of printed information selected for them.

Not all parents or teachers were persuaded to respond to either the fall or spring survey but literature was not withheld due to lack of response.

Survey instrument validation. The attitude survey instruments were developed with the assistance of a consultant, Dr. Wayne W. Welch of the Educational Research and Development Office of the University of Minnesota. The preliminary version of the instruments were tested on three different groups of girls. The first group consisted of 12 eighth grade girls from a local school who went through the forms individually in the presence of their school counselor who also served as a consultant for the project. The survey instrument was next tested with twenty 13 and 14 year old girls who were among a thousand participating in various "explorations" included in Michigan Tech's Annual Summer Youth Program.

The third group with whom the preliminary version of the survey instrument was tested was a set of 104 high school girls, mostly eleventh graders. The preliminary survey instrument was administered to them on the last day of a five day intensive workshop entitled "Women in Engineering." Girls had been selected to participate in the workshop because of their high academic achievement and demonstrated interests in science and mathematics.

The survey instruments consisted of four parts: engineering awareness, career attitudes, a semantic differential and a biographical and interest inventory. The questions about engineering sought to determine their awareness of and attitudes toward engineering careers, job placement, advancement opportunities, etc. The questions of the students' future careers sought to assess their attitudes toward and realistic knowledge of their future lives as adult women. Questions concerned career aspirations, career-family conflicts, traditional vs. nontraditional occupations for women, etc. The awareness and attitude surveys used with parents, teachers, and counselors asked essentially the same questions as those asked of the girls but wording was changed to be appropriate for their respective roles.

The project director visited all five schools in the fall of 1974 to become familiar with the school's facilities and environments, to meet the principals, and to confer with the project contact persons. All five schools provided wholehearted cooperation.

In September, an all day planning conference was held at which all key individuals got acquainted, clarified who was to do what, made several important decisions about the sequence of treatments and settled on an overall calendar for visits and distribution of literature.

The fall survey was administered during the last week in October or the first week in November except for a follow-up early in December of some absentees at Barbour. The Spring Survey was given in April and May. The contact person also distributed the form to faculty members. Questionnaires were mailed to the parents with a cover letter on the junior high school letterhead signed by the local contact person.

3. Obstacles to Implementation

The final report documents a variety of difficulties encountered in the administration of the treatments. They report that more different individuals were involved than originally planned, especially with Group B. The contact person at the Inner City school strongly advised minimizing the number of whites who would visit their students and suggested scheduling the audiovisual presentation and the minority resource persons first. At the suburban school where the busing issue had recently created ill feelings, the contact person advised against the use of any minority resource person.

Some scheduling problems were also encountered, e.g., weather and so on. A combination of complications resulted in six different engineering students being involved instead of three as intended.

The treatment grouping at the Inner City school all but collapsed because of a 30 percent drop in enrollment due to the recession which climaxed during the project. As a result, several homerooms were combined which shifted some girls from one treatment group to another halfway through the project. Data for those with mixed treatments were removed from the groups before statistical evaluations were carried out.

Problems were also encountered in dealing with the girls in Group B, and to a lesser extent, Group A. Some of these problems stemmed from difficulty in scheduling the girls to report to the desired room at the desired time. About one week in advance the contact person at each school usually sent a mimeographed list of all girls who would have to miss any class in order to participate in the project. On some occasions teachers refused to release girls from their classes despite the advance notice. In addition, control procedures at the school usually required that each girl be issued a hall pass so that she could leave her regularly scheduled class to attend the project session. Sometimes passes were not issued for every girl and some passes were misdirected. In addition, the junior high schools were often short of space and sometimes had to accommodate other projects at the same time. On at least two oaccasions this resulted in the scheduling of some other group into the room assigned to the project group and hasty compromise arrangements had to be made. Another problem encountered toward the end of the project was that some girls refused to attend the scheduled session either because of a competing event, e.g., a Kung Fu movie being shown in their English class, or because they had lost interest in the project. All these problems added to normal absences. The consequence was that not all girls in any group got the same experience.

Recruitment. The project encountered no serious difficulties in obtaining the sample of students, since it was not optional, but arranged through the administration. They did, however, have some difficulties in retention (cf. Section 3 obstacles).

The cooperation of the parents and teachers was not outstanding. The initial approach to the parents was by means of a letter over the signature of the contact person or principal of the respective junior high schools on their own school stationery. When responses did not come back at the rate hoped for, a follow-up letter was sent to parents by the project director on University letterhead. The follow-up letter for the fall survey was accompanied by a second copy of the questionnaire in case the first had been misplaced. For the spring survey, the cover letter with the survey form and the reminder letter to slow respondents were both signed by the director. Between 7 percent and 35 percent of the parents at the different schools responded to the spring survey, roughly half the number responding to the fall survey.

The response rate for the Inner City school was less than half that for the others, presumably because of less emphasis on printed media in their culture and less contact of those families with professionals.

Teacher response to the surveys was considerably short of unbounded enthusiasm although between 32 percent and 95 percent responded. However, persistence on the part of the contact persons elicited responses from a higher proportion of the teachers than could be achieved with parents.

4. Project Personnel and Consultants

Many personnel were involved in this project. Most of the administration was conducted by Dr. Clyde Work, Associate Dean of Engineering and Dr. Martha Sloane, Associate Professor of Electrical Engineering. Six different engineer students were involved in the demonstration projects as well as some industry representatives. Dr. Sloane also gave one of the sessions for treatment Group A, and one of the engineering projects session for Group B.

5. Primary Outcomes

A. Experimental outcomes. These data appeared to be amenable to statistical analysis. No results of any such analysis are given; rather the final report has many long and complicated tables reporting a percentage of change. For example, a scale based on a possible 25, reported a change from a mean of 19.32 to 20.19 as 4 percent. Further, because of the way the labels were constructed, it is sometimes difficult to understand what "changed" or what the percentage represents. Since no standard errors were reported, the evaluation team made judgments based on the magnitude regarding the possible level of significance if statistical analysis had been run of the difference.

Engineering awareness and career attitudes. There appeared to be no signficant differences between the fall and spring surveys in any of the five scales (engineering awareness, feminism, career motivation, parental interest or engineering career) between:

1. the two types of control groups
2. the types of treatment groups
3. the treatment and control groups
4. seventh and eighth graders
5. males and females (with the possible exception of the feminism scale)

6. no effect of literature on parents
7. no effect on teachers

The only substantial differences appeared in the baseline surveys of the schools: the Inner City school scored lower on all indices than either the rural or suburban schools. There was no difference, however, in the percentage of change between the schools.

Semantic differential. There was no consistent or significant pattern to these results.

Biographical-interest inventory. One result of the project was the identification of differences between girls who scored relatively high and those who scored relatively low on the Career Engineering Index. The responses for the Biographical Inventory were analyzed for girls who scored highest (top fifth) on the Engineering Career Index and those who scored relatively low (bottom fifth). Results that have a chi-square significance of 0.05 or better indicate that girls who are most interested in engineering are more likely to:

1. characterize themselves as "constantly active"
2. have a "strong" interest in fixing things
3. read outside of school
4. spend a moderate amount of time on photography
5. spend a great deal of time on chemistry
6. regard puzzles as interesting
7. have helped considerably in emergencies
8. suggest projects to friends either occasionally or frequently
9. have a math (but not a science) grade of A

Some observations obtained from this study are given in Michigan Tech's final report. The differences observed included the following.

1. Comparing the effect of treatments on girls with the highest initial scores on Engineering Awareness with those with low initial scores suggested that the treatments had a pronounced positive effect on the high scores but a lesser or even a negative effect on the others.

2. The exposure of Group A and Group B resulted in a greater increase in values of the Engineering Awareness index from fall to spring than observed in other treatment groups. No consistent differences could be observed in other indices.

3. Responses obtained from students at the suburban and rural schools resulted in from 4 to 37 percent higher values for the five indices used than for students at the Inner City school, but there were no clear cut differences between the suburban and rural schools.

4. Controls at experimental schools did show some changes that were not observed at schools where no treatments were carried out, presumably because of communication with students receiving information about engineering.

5. The Engineering Awareness and Feminism Indices for parents who received literature about engineering and careers for women increased by 12 and 8 percent relative to controls and 2 to 3 percent for other indices.

6. In the control schools where seventh and eighth graders were compared the indices obtained were somewhat (up to 10 percent) lower for eighth graders as compared to seventh graders.

7. In the two control schools where boys and girls were compared, boys' responses resulted in higher (3 to 9 percent) values of all indices than girls except Feminism for which girls were 20 percent higher.

8. Most students in each of the schools did show considerable interest in the "hands on" projects and cooperated in these activities. Most of the Group A presentations were also well received but the greater formality and lesser degree of activity made it harder to create enthusiasm.

9. The printed matter was, to a large extent, over the heads of the eighth graders except as resource material for a paper that might have been assigned. There were two noteworthy exceptions: The "Quincy" comic book (from the General Electric Company) and the booklet "Engineering: Creating a Better World" (distributed by the Engineers Council for Professional Development) which made liberal use of cartoons. Two more expensive booklets, WOMENGINEER developed by students at the University of Illinois and distributed through ECPD and the GE slick paper multi-colored booklet "What It's Like to be an Engineer" also attracted special attention. Some of the other pieces were excellent for well-motivated adults or senior high school students seeking information but less appealing to the average eighth grader.

B. Participant impact survey. Because the names were not available, no independent impact survey was conducted.

C. Site visit. The site visit was conducted in November 1975. The evaluation team met with Drs. Work and Sloane, several conselors, and several students including one who ran the demonstration project in the Inner City school. The team thought the personnel to be very competent. However, the staff was very discouraged about the completed project because of all the logistical difficulties encountered in implementing it and were not convinced that they had made any difference. We could not ascertain how long they had felt this way and whether it could have influenced the experimental results. It likely influenced the writing of the final report that was a year and a half late.

6. Secondary Outcomes

Michigan Tech has increased the female enrollment from 10 in 1971 to 200 in 1975. Although the effort toward recruiting women started when the school was in financial trouble and needed more students, the evaluation team was told that there had been a dramatic change in the awareness of male faculty members. The University now has special programs for female students where women spend evenings together, have other female contacts for special problems and personally answer inquiries from potential female students. In sum, these programs appear to be increasing the institutional support for females.

7. Materials and Dissemination

The project utilized existing printed and audiovisual materials rather than developing its own, with the exception of the survey instruments.

8. Cost

The total cost of the program amounted to $26,000. As broken down by the project into three categories, the project director distributed the total cost approximately as follows:

1. development and administering the surveys: $7,000
2. planning and administration of the treatments: $12,000
3. analyzing and reporting the results: $7,000

Literature. The cost of the literature distribution amounted to about $1.55 per student, teacher, counselor, and parents for the brochures plus an equal amount to cover the cost of planning, selecting, and distributing it.

A & B treatments. The cost of the Group A and B treatments amounted to about $30 per student including costs of salaries, travel, supplies, and administration. In individual one-shot programs, costs of these kinds of activities can often be minimized by absorbing administrative time in the duties of existing staff, relying on resource persons contributed by their employers (as was the case for the engineering practitioner in this project), borrowing audiovisual material, etc. For a large-scale effort, such savings could not be expected and the costs suggested would be real.

9. Recommendations and Conclusions

In general, this report tended to underscore our earlier recommendations. For example:

1. The project appeared to point up the need for technical assistance and standardized evaluation instruments for project directors. Specifically, it is difficult to tell whether the treatment made no difference or whether the evaluation instruments were insensitive to the changes.

2. It does not appear to be advantageous to try to persuade girls to choose science-related careers; rather it seems that reinforcing existing proclivities is more effective and efficient. This is supported by the observation which commented that girls with the highest initial scores on the Engineering Awareness index were positively affected by the treatments, whereas the low scorers were negatively affected.

3. The project also pointed up the frustrations and logistical difficulties encountered by outsiders trying to work with public school systems, as noted in the Policy Studies in Education Project.

J. "Workshop for Guidance Personnel: Engineering and
Science Career Opportunities for Women"
Michigan Technological University, Houghton, Michigan 49931
Amount: $31,500
Project Director: Clyde E. Work, College of Engineering

1. Proposed Project

The objective of the project was to examine the following three questions:

1. Can the awareness and attitudes of counselors and secondary school teachers of science and mathematics toward scientific and technical careers for women be improved by conscious treatment?

2. How much improvement in awareness and attitude can be achieved in a short period of time?

3. What changes in behavior will result from the anticipated changes in awareness and attutude?

The mechanism that was to be employed was a two-week workshop. Thirty-six participants were to be selected to form six project groups, each consisting of four guidance counselors (three from high schools and one from a junior high school) and two teachers of science and/or mathematics. Distribution between males and females was to be based on the proportions in the counselor and teacher populations of Michigan. Participants were to be chosen from schools within about 500 miles of the workshop site to minimize transportation costs.

The program was to consist of about seven half-days of presentations by outside resource people and discussion of the fields they describe and information they present, five half-days of field trips, five half-days of group project work, and three half-days of planning and project presentation and evaluation. In the project phase of the workshop, each group was to choose an approach to follow in presenting information to students in grades 7 through 12; to critically evaluate existing materials, to recommend changes and develop or revise some materials; and decide on a strategy for using the materials.

To measure changes in awareness and attitudes of workshop participants an evaluation instrument was to be administered at the time of application to attend the workshop and again at the end of the workshop. Changes in behavior were to be identified by use of a second, less formal instrument to be developed by the participants themselves during the workshop. The instrument will be self-administered at the end of the school year following the workshop, and it will call for judgments about the extent to which certain overt behaviors related to career guidance changed in the year after the workshop as compared with the year preceding it.

2. Implemented Projects

On the whole, the project went as planned and was conducted August 4 through August 15, 1975. The workshop participants divided into groups of five or six individuals. Through presentations by resource persons, laboratory experiences, field trips, audiovisual aids, printed literature, and group projects, participants were exposed to information and developed strategies for use in career guidance efforts in their own schools. Housing, travel and meals were paid for by the grant.

Recruitment. A flier announcing the workshop and inviting applications was sent in April of 1975 to 1,508 junior and senior high schools within a radius of 500 miles of the campus. Each school received two announcements: one to the principal and one to the guidance department. One hundred and sixty-five individuals expressed interest and 102 formal applications were received. Thirty-six were chosen, primarily on a demographic basis.

The only departures from the proposal were in the background of the participants. Almost half of the participants were women, most had over ten years of experience, came from large public schools, or from rural senior high schools. Although a concentrated effort was made, no minorities participated. It had also been anticipated that a higher percentage of males and guidance counselors would attend, e.g., it was to be two-thirds male and/or teachers, but only about one-half came from these groups.

3. Obstacles to Implementation

No obstacles to implementation were described other than the inability to obtain minority/inner city participants.

4. Project Personnel

There were four individuals on the team that administered the project. They were: Clyde Work, Associate Dean of Engineering at Michigan Tech; Gladys Q. Dawson, Associate Professor of Chemistry of Michigan Tech; Michael L. Agin, Associate Professor of Science Education at Michigan Tech; and Mary L. Bucklin, Counselor at Hancock High School, Michigan. Dr. Work served as project director with responsibility for visuals and printed material, and contacts with applicants and participants. Dr. Dawson was responsible for the laboratory experiences; Dr. Agin, the group projects; and Ms. Bucklin, the field trips. The entire team was involved in participant selection, administration, evaluation and reports.

The resource persons were four women and four men, representing the Society of Women Engineers, the Scientific Manpower Commission, Engineering Manpower Commission, the Federation of Organizations of Professional Women, Private Industry and the College Placement Council.

5. Primary Outcomes

A. Experimental outcomes.

1. Changes in attitudes and awareness toward engineering and careers for women. As part of the applicant procedure, all applicants responded to a 51 item semantic differential/true-false survey instrument intended to assess their knowledge and attitudes toward engineering and careers for women. The same instrument was administered at the end of the workshop. The group applying, but not participating, was not resurveyed; consequently, the participants served as their own control group, and the differences between the pre-test and the post-test responses were used as one measure of effectiveness of the workshop.

The final report indicated that (1) the participants were representative of the applicants regarding the pre-test measure; (2) there were consistent and significant increases in the knowledge and awareness of engineering between the time of application and the end of the workshop; and (3) there were consistent but smaller shifts in attitudes toward careers for women.

The items were arbitrarily clustered into eight groups and the percentage of change toward the "correct" answer was calculated. There were, however, some problems with the data analysis. For example, "don't know" was lumped on a scale with yes and no. Further, the base rate scores were quite high on some items. Finally, the data given in the report were inadequate to conduct tests of significance and none were reported. Consequently, conclusions about attitude change cannot be made.

The project, however, appeared to favorably influence attitudes and awareness of engineering as a field. The most convincing part of these data is its consistency: the change between pre- and post-responses was always toward the answer keyed as correct; only two of the 51 items did not show an improvement (however, one of the items that showed slippage was "girls should not plan to become engineers").

2. *Participants immediate evaluation of the workshops.* The participants responded to a questionnaire on the last day of the workshop. The participants gave the following ratings of the relative importance of the workshop components: first was the laboratory experiences, followed by resource persons, audiovisual aids, discussions with role models, printed material, group projects, social activities, panel discussions and field trips.

3. *Survey from one year following the workshop.* The participants formulated questions to be used in a "year later" survey to indicate how their behavior in career guidance activities had been altered. All but two of the respondents completed this survey.*

The comparison of time and efforts between the year before the workshop and the year after showed that participants did report increase in the attention they gave to nontraditional careers for women. Although not calculated in the final report, at least some of the items appeared to reach the significance level.

The participants indicated the specific activities they had engaged in during the interim year. Participants indicated that they had recontacted the workshop resources persons, had used the material generated by the groups, passed on information to students, other teachers or counselors, administrators, parents and the news media, contacted other workshop participants and changed various counseling activities. Because the questionnaire was specific, it may have increased the reliability even though a before/after comparison was not conducted. The responses regarding the interim actions are given below.

Did you contact any of the workshop resource persons or staff for further information or help during the school year? Who?

11 yes
24 no

Did you use any of the material generated by your project group or other project groups? Which? How?

31 yes
4 no

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*The report does not state whether this report was mailed to the participants a year later. In either event, knowing some of the questions to be asked may have influenced behavior.

Did you pass on to or use information obtained from the workshop with

	Yes		Yes		Yes
a) students?	34	d) administrators?	20	other?	1
b) teachers?	32	e) parents?	14	none?	1
c) counselors?	23	f) news media?	5		

all responded

Did you consult with any other of the workshop participants during the school year?

13 yes
22 no

Did you consult with any participants from your project group during the school year?

12 yes
23 no

During this year, have you been more aware of the prominence of women in nontraditional careers?

32 yes
2 no

What specific activities did you carry on to encourage females to consider nontraditional careers?

a) organize a career fair?	1
b) teach career education?	14
c) contribute to a course in career education?	15
d) develop a new course in career education?	10
e) conduct a parents workshop?	3
f) organize a career day for students and parents?	8
g) others?	16
no response	5

Have you used any specific facts or information obtained as a result of the workshop in any notes or tests you have written, program planning, speaking, or as rationale for structural change in your school?

28 yes
7 no

Have you used any information gained from the workshop in assertiveness training?

11 yes
22 no

Have you expanded your search for nontraditional careers for women as a result of the workshop?

29 yes
5 no

Has your image of careers for women been different this year than before the workshop?

31 yes
4 no

Do you feel you have changed students' (as a whole) attitudes toward careers for women?

26 yes
8 no
1 no response

Did your principal and/or others on the school staff ask or make any specific effort to discover and use what you learned at the workshop?

16 yes
18 no
1 no response

B. Participant Impact Survey. Because the participants were not women choosing careers, and participants were surveyed a year later by project personnel, no independent survey was conducted by the evaluation team.

6. Secondary Outcomes

It seems possible that the real strength of this project may be in it's secondary outcomes. As mentioned in the above section on the follow-up survey, the participants reported their activities in the year succeeding the workshop. These people reported they passed on the information obtained at the workshop to:

- students (n=34)
- other teachers (n=32)
- other counselors (n=23)
- school administrators (n=20)
- parents of students (n=14)
- the news media (n=5)

Further, there were at least 67 reports of career guidance activities encouraging females to choose nontraditional careers. Among these 67 reported activities, 11 workshops that included parents were conducted.

The figure indicates that many other persons who both directly and indirectly affect young women's career choices were reached by the workshop participants. Although the level of interaction and attitude change cannot be estimated from the data provided, it seems safe to assume that their level of awareness of career options for women was increased to some extent.

7. Materials and Dissemination

The outline of the workshop and the papers produced by the groups of participants were the only "products." To the knowledge of the evaluators, these have not received any formal distribution.

8. Costs

The total costs incurred for the project were $31,500. It is estimated that the direct costs to replicate the project would be about $16,000. This includes travel, lodging and food for both the participants and the resource persons, as well as printing, phone calls, etc. Consequently, the cost per participant is about $400.

9. Conclusions and Recommendations

1. The approach appears to have been successful and should be replicated. We feel that the leverage and ripple effects for the community may make it an effective mechanism to encourage women to choose science related careers.
2. Since some of the people incorporated the workshops with their vacations, cost-sharing arrangements between the university and the participates might be investigated. This would also set up a mechanism whereby the university hosting the workshop would benefit. Consequently, it may improve the chances for continuation without additional federal funds.
3. It may be possible to convey the same information in a shorter period of time, if necessary, and it may be more cost-effective to convey this kind of information to all school personnel on the job.

4. Some of the group projects proposed means of sharing this information with parents through PTA programs, etc. We feel these approaches deserve exploration, e.g., the workshops currently designed for the young women could also be presented at parent/teacher functions.

K. "Promoting the Exploration of Personally Relevant Career Options in Science and Technology"
The American College Testing Program
Project Amount: $49,794
Project Director: Dale J. Prediger
Director of Development Research
Educational Level: Secondary

1. Proposed Project

This project proposed to focus on ninth and twelfth grade girls who had not previously expressed an interest in a career in science or technology. The primary objectives were to evaluate the effectiveness of replicable procedures for stimulating the exploration of, preference for, and planning toward science/technology careers on the part of girls possessing personal characteristics assumed to be compatible with such careers. The secondary objectives were to identify the perceived barriers, the information needs, and facilitating factors related to the consideration of careers in science, as identified by girls with high potential for such careers. The project proposed two distinct studies: one for ninth grade girls and another for twelfth grade girls.

In the ninth grade study a sample of 360 academically capable girls in three high schools were to be stratified according to occupational preference and educational aspiration, and then randomly assigned to experimental and control groups. The experimental group was to complete a nonsex restrictive interest inventory and subsequently receive a report of results that identified specific job families related to the individual's expressed interests. A second stage treatment was to include group discussions of career planning aid and procedures.

In the twelfth grade study 1,000 girls not planning college major in science/technology but having relevant academic potential were to be identified from among the 120,000 college bound girls taking the ACT Assessment in October 1975. All subjects were to receive score reports including a section relating their career interests to college majors and job families, and booklets on educational and vocational planning. Five hundred experimental group subjects, divided into low interest and high interest groups, would also receive two mailings that noted their potential for science careers and encourage their exploration of such careers by providing related career information.

The project was expected to provide statistically evaluated and generalizable evidence concerning the effectiveness of a non-sex restrictive interest inventory, and other interventions for stimulating girls' exploration of science careers. Outcome measures would include amount of subsequent career exploration, changes in career preferences and plans, and enrollment in science-related courses.

2. Implemented Project

Both experimental designs (ninth and twelfth grade populations) were conducted very much as they were proposed. Many of the details of selection and assessment, however, were developed as a result of increasing knowledge and sensitivity to the procedures being investigated. Also, ACT simultaneously conducted an experimental program of which the NSF project was only a part.

Ninth grade program. In order to select experimental and control groups matched on selected characteristics, an interest inventory was administered to all ninth grade girls (N = 360). Both groups were separated into equal number of above-average and below-average subgroups. Above-average ability was defined for this study as anyone scoring in the upper 50th percentile (based on national norms) on the standardized test used in the school. The NSF analysis, however, was limited to above-average ability students only. The interest results were reported to small groups (N = 15-20) using Exploring, an ACT-generated career exploration booklet. Additional contacts were made through home mailings and drop-in visits with students and counselors. Following the collection of a first set of outcome measures the group discussions were conducted with the experimental group. A second set of measures was then collected. A subsequent report to control group subjects plus a third set of measures were performed and conducted independent of the NSF funding.

Twelfth grade program. Except for the rescheduling of events, some of which were postponed to be more realistic in terms of both efficiency and anticipated effectiveness, the program for twelfth grade girls also closely followed the experimental design proposed. A brochure that was to have been developed from existing materials was developed by ACT at its own expense when existing materials were found to be inadequate and/or unsuitable. Both the experimental and control groups were separated into high and low measured interests in science/technology. Nursing was excluded from these careers labeled to be science-oriented because of its predominantly female participation.

3. Obstacles to Implementation

No obstacle other than the necessity of generating the booklet were reported.

4. Project Personnel

The project was co-directed by Dr. Dale J. Prediger and Dr. Gail T. McLure. Dr. Prediger is the director of the Developmental Research Department in the Research and Development Division of ACT, a position he has held since 1970. His doctorate is in Guidance and Counseling and all of his professional experience has been in the testing and counseling areas. His career in vocational planning includes attention to problems on minority youth employment and sex bias and sex fairness in career interest inventories. Dr. McLure has degrees in education and has been with ACT since 1974. Much of her professional career has been involved in dealing with the educational needs of special populations; first with both gifted and educationally handicapped children, and with women. Dr. Richard J. Noeth, associate director for field activities, and Ms. Ellen R. Piel doctoral student in counseling and research assistant on the project, worked closely with project consultants, a multi-disciplinary group of educators, including Dr. Robert Yager, professor of science education at State University of Iowa.

5. Primary Outcomes

A. Ninth grade experimental outcomes. Outcome measures were collected from a Career Guidance Survey administered to both the intervention and control groups. The Survey was identical for the two groups except for items that measured reactions of the intervention group to the Vocational Interest Profile report. The Survey was composed of items taken largely from other ACT instruments. They included questions on (1) occupational preferences, and (2) a self report assessment of career exploration. Additional items were constructed to assess the desire for more information. High and low initiative scales were developed and used to score the exploration inventory. Items indicating active, deliberate exploration were scored on the HPI scale and those that indicated only passive, casual behavior were scored on the LPI scale. Occupation group preferences considered to fall in the science/technology area were (1) engineering, (2) national sciences and mathematics, (3) medicine, and (4) social science and legal services. Students were considered to have an interest in a career in science if either their first or second choices fell in any of the four categories. Approximately one-third of all students were considered to have abilities and interests compatible with science/technology careers.

The outcome measures were then grouped to include:

1. explorations of occupations;
2. desire for information;
3. preference for four sets of science occupations;
4. certainty of preference; and
5. certainty of required preparation.

These measures were examined in an analysis of variance with three design levels of effects: treatment, interest type, and school type. Interest type included social service, business, technical, scientific and creative arts and school type referred to urban, suburban, and rural categories.

The analysis of variance revealed no statistically significant differences on any of the primary outcome measures related to careers in science. It was reported that group guidance may even have decreased certainty about career choice. At the ninth grade level we are not at all convinced this is a negative outcome.

As far as subsidiary objectives related to the more general question of career exploration, there was significantly more exploration among the treatment students. (The extent to which the treatment itself figured into this estimation is not at all clear.) A measure of congruence between preferences and interest was higher for the intervention group but these effects appeared to dissipate three months later. General questions about the Interest Profile, such as whether students recognized more career possibilities than before, and whether they would like other students to have an opportunity to see the VIP report indicate that the students themselves seemed to see some value in the treatment, even though there was no evidence that more girls were considering science careers as a result of the project.

In summary, the VIP occupational interest profile report and group counseling sessions did not appear, in themselves, to have increased the number of young women selecting and preparing for science careers. However, there may have been more general career exploration as a result of the project. Uncertainty regarding choice may be an indication of more serious recognition of options rather than less. Within an environment of change, these reports may be of valuable assistance. However, many factors may have complicated the assessment of results:

1. The definition of social science and legal services career preferences as one of the "science" areas. With this distinction someone choosing a fine arts or social work career as first choice and law or sociology as second choice would be classified as having chosen a career in science. Rerunning the data eliminating these choices as "science" may reveal different results.

2. Experimental contamination from free access of control to intervention groups may have acted to blur any distinctions between them on career interest scales.

B. Twelfth grade experimental outcomes. The outcome measures selected for assessing the results of the twelfth grade intervention were similar to those used in the ninth grade experiment. Career exploration scores demonstrated less variance, with over half the college bound girls engaging in almost all of the exploratory methods suggested by the survey. The determination of job preferences was also similar to the ninth grade group, but the job family Social Sciences and Legal Services was excluded from the science and technology field.

Only one intervention-control group difference was statistically significant: the intervention group members were more likely to be planning to take courses in science (87 percent to 79 percent), but the control group members were more likely to be planning to take courses in math. Therefore, ACT concluded that the interventions had no appreciable effects on the college bound students in the study. On every other measure, intervention and control group differences were attributed to chance. With a large N, the probability of rejecting an acceptable hypothesis is relatively small. As with the ninth grade study, this project did not indicate the lack of need for the nonsex stereotyped career counseling as much as it pointed to the inadequacy of this intervention alone to demonstrate the impact of nonsex restrictive counseling.

C. Participant impact survey. Because of the intensive follow-up conducted by ACT, an independent assessment did not appear to be necessary. Consequently, no participant survey was conducted.

D. Site visit conclusions. The evaluation team visited ACT in November of 1975, and met the project co-directors, Drs. Prediger and McLure. At that time, the team examined the materials, and the layout for the booklet Women in Science and Technology: Careers for Today and Tomorrow. The team also became acquainted with the long history of interest by the project team in sex fair vocational testing, and were impressed by the team's commitment to the issues involved. Because of the use of geographically disparate areas, the team was unable to interview any project participants.

6. Secondary Outcomes

There is no evidence that any attempts were made to survey teachers, counselors, or parents to determine impacts on attitudes and behaviors in these groups. Institutional change as a result of this program was also a neglected measure. It is not too late, however, to use these subjects as "treatment" groups and compare attitudes with another group of controls. DRI has sent a letter to the counselors involved with the project to ascertain these outcomes, but has not yet received any responses.

An examination of perceived barriers, information needs, and facilitating factors, determined from responses to direct questions, and confirmed by a survey of other pertinent literature, suggested the following major reasons for the relative lack of participation of women in science careers in the twelfth grade women.

1. doubts about combining family life with a science career;
2. lack of knowledge about how to prepare for a career in science;
3. perception of science career preparation as being uniquely long and difficult;
4. inadequate encouragement from adults; and
5. inadequate number of role models.

Although reasons 1 through 3 are major obstacles to career planning of any kind among young women, they are even more important as obstacles to careers in science.

Ninth grade girls perceived different barriers than the twelfth graders. The ninth graders perceived the most important discouraging factor to pursuing a science career to be popular beliefs that girls are not capable of succeeding in science careers (51 percent) and discouragement by friends from entering school science courses (48 percent). By twelfth grade, the barriers were perceived difficulties in combining family responsibilities with the demands of a career (55 percent) and preparation for a career in science seemed to be very hard, long and expensive (47 percent). The forms used to obtain this information were not parallel, so direct comparisons cannot be made. The changes in perceived barriers at different "on-line" times, however, may further elucidate psychological mechanisms leading to occupational segregation. While these differing responses may indicate new awareness of the difficulty of pursuing a science career, they may also represent an adaptation (rationalization) to the social pressures indicated by the freshmen.

7. Materials and Dissemination

The project utilized three major types of materials. The Vocational Interest Profile (VIP) was used as an intervention. The VIP is a guide to vocational exploration, and was designed to minimize sex-related responses by utilizing sex fair items. Consequently a female has about an equal chance as a male of being "sent to" any given occupational family. The booklet Exploring: You and Your Career is part of this package. An update version of this package is now available, entitled VIESA (Vocational Interest, Experience and Skill Assessment). The package is self scored and can be completed in one class period.

The Career Guidance Survey was used as the outcome measure. The survey was taken from the Planning Involvement Unit of the ACT Assessment of Career Development. The self report survey assesses the amount of career exploration, occupational preferences, and certainty of preference. It is very short and easy to complete.

The development and/or validity and reliability of these instruments are reported by ACT. The survey appears to be very complete and adequately validated. Both of these are being distributed by Houghton Mifflin Company, Test Department, Box 1970, Iowa City, Iowa 52240.

The booklet Women in Science and Technology: Careers for Today and Tomorrow is self contained and excellent. It is easy to read, with many pictures, and comprehensible in content, dealing with the reasons for the absence of women in science related careers, the types of careers available, compatibility with family life, and career preparation. This booklet may be ordered from ACT.

8. Costs

The costs to reuse the material are estimated at about $1.00 per participant for the VIESA packet; this includes teacher's guides and so on. The booklet costs about .40 apiece.

We do not know the price of the Assessment of Career Development.

The booklet Women in Science and Technology: Careers for Today and Tomorrow is available for $1.50 per copy.

9. Recommendations and Conclusions

1. This study indicates that mailed material, in the absence of other interventions, is not sufficient to change the career preferences of qualified high school seniors.

97-A

The same must be concluded regarding the nonsex restrictive inventory and class discussions. In sum, while such interventions may be good, they are not enough to counter action.

2. Some evaluation of the effect on the counselors and parents should be conducted.

3. Because of the design and analysis, the outcomes of this experiment were conclusive and were reported with standard terminology. Since conclusive outcomes were the exception rather than the rule in this set of NSF experiments, the question is raised regarding the relative efficiency of funding researchers with a background in experimental design rather than persons in other disciplines.

4. Because of the interesting differences in the perceived barriers between the ninth and twelfth grade girls, we recommend a study of the perceived barriers at the time they are perceived rather than in historical retrospect.

5. The Assessment of Career Development appears to be a good vocational interest test and we would recommend its usage in other projects.

6. The booklet Women in Science and Technology: Careers for Today and Tomorrow is a well prepared document that could be incorporated into a wide variety of other career education programs.

L. "Increasing Women in Science Through Reshaping Role Perception"

Mary Baldwin College, Staunton, Virginia
Project Director: Dr. Donald Thompson
Project Amount: $99,681.98
Educational Level: Post Secondary

1. Proposed Project

The project was intended to test the hypothesis that more college women will choose careers in science if there are women role models for them to emulate; if career options are made available to them through improved counseling; and if they can be assisted in developing self-confidence as women scientists through experiential learning. The specific aims of the project were to: (1) increase the student's awareness of careers in science open to women; (2) influence the student's attitudes in the direction of more favorable perceptions of such roles; (3) enable interested students to obtain direct experience in areas of possible science careers through January term and summer internships; and (4) organize the information obtained about career options into a permanent and ongoing file so that faculty and students at the participating colleges and other interested colleges may readily retrieve this information.

Four women's colleges--Hollins College, Mary Baldwin College, Randolph-Macon Woman's College, and Sweet Briar College--were to participate in an experimental program that included several components.

Seminars featuring successful women scientists were held at Hollins College and Mary Baldwin College; exposure to a videotaped package on science careers was available at Hollins College, Mary Baldwin College, and Randolph-Macon Woman's College; and a variety of internships in scientific careers were offered at all four colleges.

The seminars were to feature four or five participants who will be on one campus for approximately one day and then will go to the other campuses for the same period of time. During each college seminar, discussions were to be open to all students and then the seminarians were to be available as resource people in science classes and as consultants for the students on an individual basis.

The content of the videotape presentations was determined by interviewing successful women scientists who were engaged in careers which are highly related to the fields of psychology, physics, chemistry, biology, and mathematics. The project director was to encourage the science and mathematics faculties at Hollins College, Mary Baldwin College, and Randolph-Macon Woman's College to incorporate the videotaped presentations into their respective science courses.

During the course of the project, the director was to assemble detailed information on careers in science for women. This information was to be disseminated at the close of the project. On all campuses central files were to be established, and these files would be made available to faculty and students for up-to-date information. In addition, increased opportunities were to be made available for student externships during the January term and during the summer months. These externships were to include 160 hours of on-the-job experience at various industries and agencies involved in science-related endeavors for which credit would be given.

Evaluation of the project was to be made by analyzing the results of tests on attitudes toward science and scientific careers given before and after the program at the four colleges and by cross-comparisons among all four colleges.

2. Implemented Project

The project was conducted much as it was planned. Six seminars on science careers in industry, in government, in environmental fields, in the behavioral sciences, and in medicine were held. A more general workshop on the image of the woman scientist was substituted for the workshop on teaching careers in science. All of the workshops were well attended.

Twenty-five or 30 videotapes were produced from interviews with successful women scientists. The content of these interviews centered around educational backgrounds, job procurement, and personal and job satisfaction and dissatisfactions. The seminars were also recorded on tape. A total of 147 students viewed at least one of these tapes, and many students viewed more than one tape.

One hundred nine women participated in the externships, the majority of these women experienced more than one externship. To accommodate this number of women, 41 additional sponsors were recruited.

One element added to the project was the opportunity for senior students at Mary Baldwin who, at the time of pretesting, stated that they were undecided about their future career to attend a weekend workshop on career decisions. Although four such workshops were planned, only one was held. Six women attended. In addition, all of the first year students were given the opportunity to have the vocational interest inventory administered by the project interpreted by counseling personnel, and those who had them interpreted were invited back for further career exploration. One hundred ninety-seven women discussed their vocational tests with a counselor, and 12 returned for further exploration.

Some difficulty in retaining the isolation of control and experimental groups was encountered. Specifically, in addition to some loss of post experimental data, the group designated as control was switched from Sweet Briar College to Randolph-Macon because the faculty at Randolph-Macon refused to show the videotapes. Consequently, some of the planned evaluation analyses could not be conducted.

Recruitment and sampling. The project was aimed at two distinct populations. One was all first year students at the four schools irrespective of their intended major. The other was the junior class science majors in those schools. Presumably, the aim of including first year students was to introduce/influence them toward science-related careers, while the aim of including junior science majors was to reinforce their decision and to provide them with additional information regarding their chosen careers. In addition to these two groups, many of the activities were open to the entire student body, and numerous individuals not in the target group participated in some of the events. Results, however, are only reported for the target group of freshmen and juniors.

Pre-intervention data were collected on 87 percent of the first year women at all four colleges and from 91 percent of the science majors from these schools. About 75 percent of the women pretested were surveyed one year later. Completed data were available on 74 science majors and on 459 sophomores. Participation in the testing, as in all activities, was voluntary and represented a self-selected sample. The size of the sample, however, suggests that the self-selection of the pretest and posttest sample did not dramatically affect the results.

Most of the information regarding project activities was transmitted through posters, the campus newspaper, and by faculty members. Invitations for the seminar were sent to science majors and a randomly selected group of first year students.

3. Obstacles to Implementation

In general, the project ran smoothly. The principal investigator reported some difficulties in coordinating data collection activities between campuses. Specifically, although good cooperation was given by the college liaisons on the executive committee, the faculty members were not given release time to conduct project activities. Consequently, some of the activities could not be conducted as they were planned. This appears to have a greater impact on the experimental nature of the results, rather than program impact.

4. Project Personnel

The project director was Donald Thompson, Ed.D., on staff at the psychology department. Dr. Thompson is an energetic, outgoing individual who appeared to be well liked by the students. He was well qualified to run the program. He was assisted by a research associate, Ms. Hinda Levin, who was primarily responsible for data analysis, and a publicity specialist, Ms. Sandy Harris, who was primarily responsible for logistical arrangements.

An executive committee included one representative from each college. This committee served as the coordinating committee, and each member served as the liaison with her/his campus.

One of the most important aspects of the program was the female role models used in the seminars and the videotapes. The women represented a wide variety of fields, occupations, and life-styles, e.g., there were about 30 women representing the health fields, research jobs, government and industry jobs, the behavioral and environmental sciences. Some were married with children, some married without children and some were single. The role models also represented a range of degree levels and accomplishments. Many, if not most, of the women were Mary Baldwin graduates, and currently resided in the southern United States. The role models were consistently rated very favorably by the seminar attendees.

5. Primary Outcomes

a. Experimental outcomes. Most of the outcome indicators did not show a significant change from pretest to posttest period across the four schools. For example, the percentage of women pretested as first year students who intended to major in science remained constant at about 30 percent. No significant changes in the rankings on the 22 categories on the Educational Interest Inventory were noted, and no significant changes in attitudes toward science were observed, although a slight positive increase was apparent. The percentage of these women on whom measurements were taken that directly participated in the program is not known. Therefore, it must be concluded that no changes in short-term indicators in the general target population was found.

Mary Baldwin College students participated in the experimental activities to a greater extent than students from other schools. Consequently, more favorable results might be expected. Several indices suggest that this is the case. At Mary Baldwin, there has been an overall increase in the number of science majors. The number increased from 18.8 percent in the fall of 1975 to 34.9 percent in the winter of 1976 to 38.0 percent in the spring of 1977. That is, the number of students at Mary Baldwin who changed their proposed major from non-science to science was significantly greater than the number who changed their proposed major from science to nonscience. These were not necessarily the target group of first year students. The science interest scores remained about constant over the period, but the attitude toward science score increased somewhat.

A more stringent way to examine the direct affect of the programs is to investigate the change scores of the actual participants and the effect of extent of participation, e.g., to look at those women who actually participated in the project events. The results of the project showed an interrelationship between participation in various project events that was very strong and significant for science majors, and moderate but significant for first year students. In other words, approximately the same group of people experienced most of the project components. By inference, many of the target group tested experienced few of the project events. Unfortunately, although participation was positively related to overall interest and attitude scores, only the sum of the pretest and posttest measures were used. Specifically, the change in these scores was not correlated with participation, so it is impossible to determine whether the relationships shown was a function of high initial scores.

Since participation in the seminars and externships were voluntary, attendance may also be used as a criterion of success. The final report calculated that a total of 217 individuals from the entering class attended the seminars. These figures, however, dramatically underestimate total seminar attendance, e.g., 40 from the target group of first year students and science majors attended the first seminar at Mary Baldwin College, but the total attendance was 103. The total attendance for all of the seminars was 769, and attendance appeared to decrease only slightly over successive seminars. The extent of the attendance at the seminars would suggest that these met some need of science and nonscience majors alike. The student evaluations of the seminars indicated that the seminars were well received and thought to be valuable.

A total of 85 first year students and 24 junior science majors participated in externships. Many of the students expressed satisfaction by participating in multiple externships.

The videotapes were viewed and evaluated by approximately 119 freshmen and 28 junior science majors. The project data indicated that the majority of the students felt the videotapes could direct undergraduates toward a career in science. Most of the comments about the videotapes concerned their technical quality. No analysis of their affect on the outcome measures was reported.

The seminars were also evaluated by the attendees. The majority of the attendees responding to the questionnaire felt these seminars could direct a student toward science. A very small minority felt they could direct students away from the careers in science. The participants also expressed satisfaction with the externship experiences by rating it as rewarding.

b. Participant impact survey. Because of the late inception of the project, DRI did not conduct an independent participant impact survey.

c. Site visit conclusions. The site visit was conducted early in the life of the project at the time the first seminar was held.

One videotape was already completed and was viewed by one member of the evaluation team. The interview had been videotaped in a quiet setting, and was an "informal chat" with a woman scientist. It was felt that the videotape was sufficiently well done to be usable and informative by many educators.

Two seminars were attended by the evaluator. The seminars were well attended, went smoothly, and generated many questions from the audience. The refreshment period allocated to talk to the role models on a one-to-one basis was also well attended, although the majority of the women attending the seminar did not stay for refreshments. The women had specific questions to ask the role models and it appeared that the conversations could have lasted many hours if possible. During this time, the evaluator visited with 15 or 20 women. They were uniformly pleased with the seminar, and all seemed anxious for career information from the role models. This informal coffee hour appeared to be an important and highly successful aspect of the program that should be included wherever possible.

The role models also enjoyed the experience. The planning and coordination of their activities was well done.

6. Secondary Outcomes

There were several secondary outcomes of this project. The first is the additional information gained from the seminars by the nontarget population. As noted previously, many sophomores and seniors attended. Their attendance may have been responsible either directly or indirectly for the increase in science majors observed at Mary Baldwin College. The project may have directly influenced the nontarget attendees to shift majors, or indirectly influenced a changing attitudinal climate.

Another secondary project impact may have been on the faculty members at the participating institutions. Specifically, the science faculty was invited to all of the seminars, and at least some attended. This may have increased their interest in science-related careers for women, and increased their awareness of science-related career options outside of teaching occupations. The individuals in industry or private practice guiding the young women through their externships may have also become more aware of science areas as appropriate occupations for young women.

A fourth secondary impact may have been on the role models. Many of the role models became friends during the program, and increased their "network." In at least two instances known to the evaluation team, the relationship formed during the seminars has resulted in a productive working relationship between the role models.

In addition, Mary Baldwin College made some alterations in its structure at least in part to continue the project activities. They have formed a women's center that will be responsible for administering certain of the career education and placement activities. They now have a department to administer externships, and have decided to utilize externships as the primary placement activity. Since the vocational interest inventory indicated that many students were interested in the field of communications, plans have been made to initiate a communications department at the school. The principal investigator summed it up by commenting that the NSF program had increased the institutional responsiveness to the needs of the student.

7. Materials and Dissemination

One of the objectives of the project was to organize the information obtained about career options into a permanent and ongoing file so that faculty and students at the participating colleges and other colleges may easily retrieve this information. The project obtained printed materials from 75 government agencies, businesses and professional organizations. These have been distributed to all of the schools. In addition, an annotated bibliography on science careers is being prepared for distribution by the project staff. No information on the extent they are being used is available.

The status and/or distribution plans of the videotapes are unknown to the evaluation team.

Another "product" of the project is the development of 41 externships that may be used by future students.

8. Program Costs

It is extremely difficult to calculate program costs. The total cost of the program was approximately $100,000. The number of individuals reached (if double counts are included) was about 1,000, including total numbers attending the seminars, the videotape viewing and the externships. The direct cost, then, was about $100 per participant. This figure represents considerable underestimation of cost per actual participant because the same individuals frequently participated in several project activities.

Future replication of project activities might be less expensive. The cost of project operation could be reduced by one-third if clear development tasks are deleted and half-time for project director is sufficient ($60 per participant).

However, the primary operation costs of continuing such a project may be quite modest. For example, the travel expenses and publicity of the role models for the seminars was estimated to be $9,000. If the 800 attendance mark could be sustained, the cost would average about $11.25 per attendee. The costs could be further reduced if more students attended each seminar. Likewise, further use of the videotapes, externships and vocational counseling activities would likely be small, and possibly absorbed by the institution.

9. Summary and Conclusions

The project comprised of seminars, career counseling, externships and videotaped career information represented the most comprehensive intervention of the post secondary projects. The project was aimed at first year students and the junior science majors at four women's colleges, although all students from the schools could participate in some of the program activities. These activities represented an increased effort and modified focus of ongoing programs which have now been institutionalized at Mary Baldwin College. There was differential participation in the project: the campus of the project director participated to the greatest extent; junior science majors were more involved than freshmen; but freshmen who anticipated a science major and those who did not were proportionally represented.

During the period of project activities the percentage of declared science majors increased substantially at the campus where the activities were concentrated. Although this may have been due to multiple causes, it seems likely that the project activities or their secondary impacts contributed to this effect. No specific activities can be implicated because the target group of freshmen and juniors declaring science majors remained relatively constant and shifts from science to nonscience majors and from nonscience to science* were not significantly different. The project can also be judged a success if rate of participation and participant satisfaction are used as criteria. In addition, many positive secondary outcomes resulted on the Mary Baldwin campus.

There were several parts of the project that were suggestive and interestingly, but not completely, explored by the project evaluation. These are:

1. The cooperative arrangement between relatively contiguous schools represented a promising cost-effective approach to career information activities. Yet the evidence indicates that the school participated and benefited differentially. It is possible that the logistical barriers encountered may be surmounted once the activities were operational rather than experimental. On the other hand, personal

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*This was treated as an equally probable event in the analysis although national data suggest that a shift from science to nonscience is the more probable event.

commitment and responsibility of the institutional members may have more far reaching affects than the activities themselves.

2. The study had the potential for reinforcing existing decisions. While it certainly performed this necessary function, it also provided career information for those women not choosing science-related careers. The overall effect on the campus where activities were concentrated suggests that activities may be beneficial to both groups.

3. The externships represented a unique component of this project, and, in general, served to enhance career commitment among the junior science majors. In addition, such externships provide a close, more realistically based relationship between the community and the colleges that should serve both to increase career awareness on the part of the faculty and to increase the employability of its graduates.

4. The most unfortunate part of the experiment was its failure to indicate the effects of exposure to project activities in order to provide an indication of necessary level of effort needed to reverse the flow of women away from science majors. In this experiment, as with almost all naturalistic experiments, no reasons for the increase in science majors could be postulated from the experimental results, e.g., the differential effects of project activities on attitudes was not determined.

5. Many of the project activities, such as the externships, career material and videotapes are being continued in the absence of NSF funding.

6. The fact that role models were graduates of the local colleges probably enhanced their effect, e.g., the majority of the role models had graduated from Hollins or Mary Baldwin. This likely increased student identification with the role models and their success seemed attainable.

7. The affect of the additional career counseling is not clear; e.g., its influence on freshmen was not analyzed. In addition, the low attendance at the weekend seminar on career counseling and assertiveness is not discussed. The lack of enthusiasm on this topic is interesting in light of the good reception of the seminars and externships.

CHAPTER III
PROGRAM OBSERVATIONS AND COMPARATIVE ANALYSIS

Although aimed at science-related careers, many of the recommendations of this report, especially at the primary and secondary school levels, apply equally to all nontraditional jobs, especially those that are highly technical. Therefore, the authors feel that the same recommendations may apply to many interventions designed to increase the awareness of women regarding employment alternatives and options and to increase their participation in many nontraditional careers.

The projects described in this report were aimed, in general, at motivating and reinforcing decisions to enter professional careers in science, for preparing effectively for those careers, and for removing barriers to the attainment of those aspirations. All of the scientific and engineering positions described in the materials developed by these projects required at least a college degree, and most required advanced degrees including a doctorate. On the whole, those women receiving doctorates in science-related fields are productively and continuously employed, and salary differentials between men and women is less than men and women with less education. That is, it appears that a Ph.D. may be an "equalizer." Since these women may also serve as visible examples of the employment potential of females, they may serve to increase the aspirations of other equally talented women. Therefore, it would seem desirable to increase the proportion of women in this category. Since the recommendations may only apply to a small number of women, they are treated independently in this report. The recommendations incorporate the evaluators' observations, derived from a comparative analysis of the projects, and should be considered as hypotheses to be tested since definitive conclusions could not be made from the present projects.

Although this report has concluded that there is probably a higher success rate to be expected by funding programs for high ability, highly motivated groups, and has recommended concentrating on reinforcement programs for these people, there is no evidence that the need is not greater among low motivation, low self-esteem groups. Assuming these groups are larger, it is possible that the potential output would be greater even though the "success rate" may be lower.

Moreover, the consequences of adequate science and mathematics background and awareness of broad career options may have widespread impact on women in the society. For example, comprehension of mathematic and scientific principles may serve to "demystify" a technological environment and decrease a sense of helplessness and lack of self-confidence. Further, the acceptance of nontraditional career options, even for those not choosing to pursue them, may create a more supportive environment for those who do choose them.

Finally, a number of nontraditional nonprofessional science-related jobs exist which, for many women, would represent both economic and social benefits: electronics-, video-, sound- or flight-technicians, computer operators, highly skilled labor, etc. These are jobs that require science-oriented preparation and contribute to the emerging role of women as productive partners in providing highly specialized support skills in a technological society. Although these positions do not usually require college degrees or the same high degree of academic learning ability, they do require early exposure and commitment, continued encouragement, and special training. They represent improved earnings and more respected skills than many traditionally female jobs. For these reasons it may be just as desirable to increase the number of women participating in these careers. Recommendations concerning career education programs are given separately in this report.

Reentry is a critical area for increasing the participation in science-related occupations, e.g., many more women are qualified for these occupations than are currently employed in them. For example, the Scientific Manpower Commission reports that women earned about 35 percent of the bachelor's degrees in mathematics between 1948 and 1973, 25 percent of the master's degrees and 10 percent of the doctorates. Far fewer at each degree level are employed, and the underemployment appears to increase as the level of degree decreases. Approximately 87 percent of the Ph.D. recipients in math are employed, but only about 28 percent of the master's degree recipients and about 31 percent of the bachelor's recipients are working in math related occupations. Similarly, the pool of women qualified to be employed as chemists is about 20 percent of the total pool, but only about 8 percent of the working chemists are female. The percentage of working Ph.D. recipients may be higher than that of lower degree recipients only because a greater percentage of them are continuously employed.

Clearly, underutilization of females in the economic sector is a widespread problem. In fact, in view of the pool of qualified women, it may be more imperative to address the reasons resulting in their underutilization and to develop remedial interventions than to encourage more women to prepare themselves for these careers. Consequently, reentry programs, designed to meet the specialized educational and emotional needs of all women, professional or not, are discussed in a separate section.

A. Professional Careers--Observations From the Projects

Among the objectives of this contract was the examination of the results occurring across projects in order to isolate observable patterns by the type of intervention, types of materials, age groups and other variables that might have relevance in the implementation of similar projects. This analysis may be called program strategy analysis or comparative analysis.

Unfortunately, none of the projects proved to be effective as judged by rigorous statistical methods, either because of the problems in design, control group implementation, and outcome measures, or because the treatment actually had no effect. Therefore, the evaluation team employed a "preponderance of evidence" criteria for judging the effectiveness of a project. That is, some combination of the statistical results, other nondesign outcomes such as experiences with a roughly comparable group, the opinions of the participants, and our own impressions was used to judge whether a project was effective. Under these conditions, even if "success" was indicated, no causal reason for the success could be determined. Consequently, commonalities between the more successful and less successful projects were explored. Because of the experimental limitations on the conclusions, these observations should be treated as hypotheses to be tested, and not as recommendations.

Even when statistically significant results were obtained by the experiments, these were frequently difficult to interpret and place in perspective. The difficulty was encountered under several circumstances. First, frequently a multitude of items were used in the evaluation instrument, but only a few items were significant. Further, when a variety of outcome measures were used, some of the significant outcomes may have been interesting and/or beneficial, but not directly relevant to encouraging women to choose science-related careers. A third difficulty was when different "control" groups indicated different results, such as with the University of Kansas study. A fourth difficulty was the probable Hawthorne effect, where the novelty of the intervention may have skewed the results. On the other hand, multiple year projects (University of Oklahoma) were difficult to analyze because the effects may have been cumulative and not directly related to the segment that NSF sponsored.

Therefore, the indicators used to estimate effectiveness, were at best, only global measures, frequently not conceived of as part of the experimental design. Consequently, the reason for the outcome could not be conclusively determined. For example, the special math course at UMKC appeared to be effective in encouraging women to take subsequent math courses. However, the comparison group were those taking math courses the year before, and those taking a different math course the same year. Therefore, the interest in mathematics might be attributed to any of the following: (1) the actual curriculum, (2) the method of instruction, (3) the additional tutorial help, (4) the all-female classes, (5) the influence of the instructors, (6) the "Hawthorne" effect, and (7) the differences in the population that would sign up for the course.

The projects are described in three tables. Table 1 breaks down the 11 projects by the age of the participants, the sex of the participants, the types of treatment, and whether the treatment was available at different intervals (spaced), or given all at one time (massed). Finally, the outcome of the experiment is given. Table 2 lists the products of each of the projects, and their potential applicability, and Table 3 contains a rough estimate of the cost to reuse that particular intervention and a subjective assessment of its effectiveness.

The subjective assessment regarding the effectiveness is reported in three categories: probably effective, no effect, and possibly a negative effect.

The special math course offered by the University of Missouri at Kansas City (UMKC), the workshop offered by the University of Oklahoma and the workshop offered by Michigan Tech for counselors and teachers and the workshops at the University of Kansas appear to represent the most viable strategies. UMKC reported a much greater percentage of women taking subsequent math courses, although no true control group was available for statistical comparison. Similarly, the University of Oklahoma workshop reported a higher percentage of women reporting that they would choose an engineering major than a noncomparable control group. The participants in the University of Kansas workshops reported more science majors than the year before, but about the same as the control group composed of individuals who were invited to the workshop but did not attend. The counselors/teachers workshop, sponsored by Michigan Tech, reported a consistent, but slight, increase in awareness of engineering as a career for women, and reported increased activities regarding these careers on a form that the participants devised. Consequently, the commonalities between these programs that may have been successful are discussed.

The ACT nonsex restrictive vocational inventory, the MIT film, the Michigan Tech program for students, Queensborough's cassettes and slides, and Rosemont's program to update skills reported having little effect when used as the primary intervention. Rosemont was included in this category because at the time of the report, only 25 percent of the seven participants had obtained jobs, and this appeared to be about average for women making some active effort to get them. Goucher and Policy Studies indicated that their project might have had a negative effect on the participants. Commonalities between these projects are discussed.

Some of the commonalities we observed and areas where we recommended further investigation are as follows.

TABLE 1
PROJECT DESCRIPTIONS

	Grade	Sex/ Sample	Intervention	Contact Time	Results
Michigan Tech	8th	F	Presentation by role models of preparation, job content and lifestyle in engineering.	4 hrs.	No significant results.
	8th	F	Demonstration projects.	4 hrs.	No significant results.
	8th	F	Mailed printed matter.	1 hr.	No significant results.
ACT	9th	F	Given non-sex biased career inventory, discussion groups, and printed matter.	2 hrs.	More career exploration, increased congruence between aptitude and aspirations.
Policy Studies	10th, 11th	F	Workshops in school on lifestyle and career clusters.	12 hrs.	No significant results--slight trend toward disinterest in science.
MIT	10th, 11th, 12th	M,F	Film and booklet.	1 hr.	More in experimental group undecided about career plans--same amount definitely wanting engineering.
Goucher	11th	F	College level semester course in science.	15 hrs.	Significant decline in interest in science at end of course, but 58% of respondents planning science career one year later.

TABLE 1 (continued)

	Grade	Sex/ Sample	Intervention	Contact Time	Results
Oklahoma	11th, 12th	F	Workshop of mixed discussions, labs and field trips.	40 hrs.	Probably increased number of women planning engineering careers (not adequately tested).
ACT	12th	F	Mailings of relevant materials & VIP inventory.	2 hrs.	More planning taking courses in science but more control planning to take math
Kansas	12th	F/high ability	Workshop.	8 hrs.	Significantly more women pursuing science careers than women in prior year control; but same percent as women who were invited to workshop but did not attend.
Queensborough	9-12	M,F	Slides and cassette of six role models.	1 hr.	No significant differences.
Michigan Tech	Parents	M,F	Printed matter mailed.	1 hr.	No significant differences.
Michigan Tech	Teachers	M,F	Printed matter distributed.	1 hr.	No significant differences.
Michigan Tech	Teachers, counselors	M,F	Workshop with role models, labs, discussion.	80 hrs	No significant difference in participants but may have increased activity in school community.
Kansas	Parents	M,F	Workshop on career materials with daughters.	8 hrs	Not measured; daughters reported it as positive.

TABLE 1 (continued)

	Grade	Sex/ Sample	Intervention	Contact Time	Results
Missouri	College	F	Special math course.	1 sem. 80 hrs.	More took further math courses in sequence.
Rosemont	Post-grad	F	Course to update skills and industry internship.	100 hrs.	About 1/4 did get jobs in science-related areas.

TABLE 2
PROJECT MATERIALS

Material	Appropriate Age	Description	Dissemination
1. Choosing a Career--Women's Work: Engineering (MIT) book	All secondary and college engineering students.	Description of three female engineers--student, young professional, middle age professional/all lifestyles represented.	May be used for TV and distributed on film by Educational Development Center Inc. Now available from MIT catalogue.
2. Women in Engineering (MIT) film	All secondary and college engineering students.	Shows students and professional women in engineering at work and home.	"
Exploring (ACT)	Secondary.	Updated version called VIESA: book on job clusters and aptitudes, career planning--non-sex restrictive.	Part of Houghton Mifflin "Career Planning Program."
Vocational Interest Profile (VIP) (ACT)	Secondary.	Non-sex restrictive career assessment/intervention.	"
Women in Science and Technology: Careers for Today and Tomorrow (ACT)	Secondary.	Booklet describing realities on women in science-related careers.	ACT. Nice booklet that should be widely used.
Workshop format (Kansas)	Secondary, college.	Series of self awareness exercises.	None.
Women in the Professions (Kansas)	Secondary, college.	Home study course designed for three credits.	None.

TABLE 2 (continued)

Material	Appropriate Age	Description	Dissemination
Women in Science (Queensborough)	College, graduate school.	Interviews with six of top female scientists: mixed ethnic background and variety of lifestyles.	American Association of Physics Teachers and NSTA distributing. Should probably be used in conjunction with other material except at graduate level--may be better at college level than secondary.
Workshop Curriculum (Policy Studies)	Secondary	Mixture of job clusters and lifestyle alternatives.	None.

TABLE 3
PROJECT COST PER PARTICIPANT

	Intervention	Hours*	Cost	Effectiveness
University of Kansas	exploration workshop	8.00	10.00	possibly positive
Policy Studies	career education course	12.00	50.00	no effect or negative
Queensborough	slide and tapes	1.0	1.00	no effect
Massachusetts Institute of Technology	film	1.0	2.00	unknown
Univ. Miss. at Kansas City	math course	64.00	350.00	probably positive
Rosemont	chemistry course	100+	800.00	positive for small proportion
University of Oklahoma	workshop	40.00	300.00	possibly positive
American College Testing	literature mailing	.10	1.65	no effect
	nonsex restrictive interest inventory	1.0	1.00	no effect
Goucher	research course	30.00	1,000.00	no effect or negative
Michigan Tech	student literature	1.0	1.55	no effect
	student seminars	4.0	30.00	no effect
	parents literature	1.0	1.55	no effect
Michigan Tech	counselor teacher workshop	112.00	400.00	probably positive

*Estimates minimum contact time; the time may have been greater for some participants.

1. Concentrating on women who are already interested in science. In general, it is thought that projects providing support for women interested in science, and projects to remove barriers to the full participation of these women, are preferable to direct motivational projects to encourage women to change their interests for the following reasons:

- They are more easily justified in terms of providing equal opportunity and avoiding criticisms of reverse discrimination.
- They are less apt to result in unsatisfactory career choices.
- None of the projects observed appeared to be successful in changing attitudes.
- It is difficult to switch from a nonscience to a science area. That is, beyond the junior year in high school, compensating for inadequate math and science backgrounds is difficult.

Since the projects examined did not appear to be successful in changing occupational choices at the senior high level, intensive support and information could be provided to those women having the necessary background, ability and motivation to pursue their existing interests.

While there is not an established theory on the vocational choice patterns of women, there has been a growing number of studies in the area. Most of the literature appears to be in agreement that there are many shifts in both occupational interests and commitment to a career. However, the literature uniformly indicates that from preadolescence on the shift is toward typically feminine careers and away from nontraditional careers (e.g., Angrist, 1970; Harmon, 1971). Consequently, interest should be defined very liberally, and should not be interpreted to mean an expressed career choice.

The kinds of support that may be helpful can come from a wide variety of sources, and the most important source will be different for each age group. These support programs could include parental support, encouragement from teachers, peer support (both same and opposite sex), guidance counselors and from the institution as a whole. The range of possible forms these programs may take is virtually infinite and could include counselor workshops, special housing programs, special workshops for science/math teachers, or sex-segregated classes.

2. Concentrating on women with above average aptitude and motivation. Realistically, professional careers in science-related areas require intellectual ability, an adequate background derived from math and science courses, and more than average motivation. In fact, having completed advanced mathematics and science courses successfully is probably a good indicator of ability and motivation. Although there is a controversy about the measuring of aptitude and ability (Prediger and Hanson, 1976; Schmidt and Hunter, 1974), it seems feasible to determine whether individuals have at least average ability or are highly motivated by utilizing either standardized test scores, grade point averages, or the courses chosen and completed.

Many studies have shown a relationship between career commitment in general and measures of accomplishment and/or aptitude (e.g., Hoyt and Kennedy, 1958 and Tyler, 1964). Further, a higher level of aptitude appears to be related to the choice of nontraditional careers, e.g., those occupations dominated by males (e.g., Astin, 1971). Consequently, it would appear that intensive and/or expensive programs should concentrate on women who have either a high ability or who have taken the necessary requisite course or overtly express an interest in science.

This hypothesis was substantiated by the projects: the more successful strategies/projects utilized a motivated population, while the ones judged less effective did not. For example, the Kansas workshops invited only women that had been selected for admission to KU, Oklahoma University required active motivation to apply, as did Michigan Tech. On the other hand, the two studies categorized as "possibly negative" reported severe problems getting young women of adequate ability; and one report contained reservations about the participants' motivations. The majority of the studies reporting no results had no special requirements regarding either the motivation or aptitude of the participants.

One indicia of motivation may be found in the participant selection procedures: University of Missouri at Kansas City, University of Oklahoma and Michigan Tech all had self-selection procedures; only those individuals who wanted to participate attended. On the other hand, some of the projects had more or less captive participation; the intervention was administered in classrooms, or the entire class participated.

The self-selection, of course, provided a strong experimental bias toward success, and mitigated any conclusions about the intervention itself. However, since the aim of further implementation is to bias the projects toward successful outcomes, voluntary participation may be a judicious procedure.

3. Using workshops as a format for the intervention. Although it is very possible that the selection procedures for the workshops was a greater determinant of outcome than the format, the hypothesis is proposed that concentrated "live-in" workshops may be effective. These workshops may offer a wide variety of activities as in the University of Oklahoma, Michigan Tech and KU projects, may be the more enjoyable and effective format to provide support and information for young women interested in science.

4. Encouraging participant interaction. Social psychology would predict that other persons sharing similar outlooks and attitudes could provide reenforcement for women choosing nontraditional careers and/or lifestyles. The projects provided some evidence for this assumption. The live-in workshop, where participants with similar interests spent concentrated periods of time together, provided a perfect environment to obtain these rewards. In the special math class, informal tutoring at the noon hour was available and provided the same opportunity. On the other hand, the larger class situations and/or media presentations were generally less successful and did not provide an opportunity for participant interaction. The Goucher project entailing basic science research did provide this atmosphere, but participants reported that they did not form any new friendships.

5. Using sustained contact periods. When the treatment did not require intense concentration and work, the longer periods of time for administration of the treatment appeared to be more effective, possibly because of the increased opportunity to make new friends with people sharing similar outlooks. The more successful interventions appeared to require at least eight contact hours. It is possible that short "one-shot" affairs may not be sufficient to counteract existing cultural mores discouraging women from choosing science-related careers. However, since some other projects of greater length did not appear to be successful, careful examination of related variables should be conducted. The length of exposure may be one of the reasons why the media products did not appear to have a demonstrable effect.

6. Using role models in as many situations as possible. Uniformly, role models appeared to be the most effective component of some of the projects and were the primary material for the media products. The original connotation of a role model was a person in a position of influence that one could identify with; most of the projects did incorporate these younger women in mid-level positions. In one of the projects containing a mix of role models, the younger women were judged most effective by the participants. In this respect, then, choosing the role models closer in age and only slightly above the level of aspiration of the participants may be advisable.

The evaluation team, however, feels that there is also real value in depicting the most successful women of our time. Although very few women (or men) may be able to identify with these outstanding people, they demonstrate that a woman can "make it," they are a source of pride for the women, and may serve as an inspiration. Consequently, a mix of age groups and levels of accomplishment (as well as lifestyles, ethnicity and so on) is recommended.

The area of concentration of the role models did not appear to have any impact; the more important factor was that they genuinely enjoyed their work and their lives.

7. Using "hands-on" experiences. In many of the projects, various types of hands-on experiences were used. Very frequently, these were engineering or science projects. These activities were rated highly by the participants. They appeared to be most effective when they were group projects, continuing over a period of time, e.g., when they facilitated the formation of social relationships. Also the active participation in these and other activities appeared to enhance the effectiveness of every kind of intervention.

8. Segregating some activities by sex. Although in theory, as well as in practice, sex-segregated classes might be considered counter productive since women live and work in a world with men, a consistent comment on the part of many of the participants was that they preferred all-female seminars. This comment extended to a preference for female tutors in math. The young women commented that they felt more free to ask (what they considered) "dumb" questions, to appear as "bright" as they are, and to discuss their personal life and ambitions. Consequently, although a sad commentary on socialization and peer pressure, sex-segregated classes appear to be useful in situations where remediation skills or personal questions are involved. These classes, however, could incorporate methods to lead to more open discussions with male peers and parents, once the women have gained self-confidence and support from their same-sex peers.

9. Emphasizing the social contribution of science. One of the myths of science-related careers, not directly dispelled in any of the projects we observed, is the absence of emphasis on social importance and social interaction in science careers, e.g., scientists/engineers were frequently not portrayed as persons with extensive social/environmental concerns and responsibilities who interacted with the community. Since women are reputed to be very interested in social welfare, emphasizing the input of science to the well-being of society, and a deep involvement with people, might enhance the desirability of the profession. Moreover, the greater the number of scientists whose interests supercede "the testtube," the greater the potential impact of scientists on society in areas other than technology.

Consequently, we would recommend, on the basis of the experience gained by these projects, further examination of a format where able and motivated young women, having some interest in science, gather for a workshop having the ingredients of role models, hands-on experiences, and the opportunity for new friendships. This format is quite similar to the existing Student Science Training Program,* which still does not have full participation by females, and has a demonstrated success rate in turning out scientists (Vidulich, Christman, Drake and Kirk, 1976), e.g., about 50 percent of the females participating in these programs expressed career aspirations in science.

Similar experiences could be provided for both college and graduate students. David (1971) concluded that "earning a doctorate is the factor that most equalizes the women to the men in science and engineering," in terms of employment, salary and contribution to their field (p. 222). However, of students entering graduate school, possibly twice as many men as women actually complete the degree. If the doctorate is an equalizing factor in employment, salary and accomplishment, special programs to encourage completion (and to contribute to the supply of role models and female faculty members) should be conducted. These programs might include female colloquium, particular speakers, support groups, internships, workshops and seminars or nationally conducted week-long seminars for female graduate students.

10. Removing institutional barriers to female participation in science careers. Although the NSF projects were not directly concerned with overt discrimination, many observations regarding the obstacles they presented became apparent to the evaluation team.

Not only do women pursuing nontraditional careers encounter social barriers, they frequently encounter institutional barriers. Even those schools professing equal opportunity for financial aid, intern programs, etc., frequently have not adapted them to the special needs of women. This discrimination, and misinformation, starts very early and continues through her educational and job career, and has to be a discouraging factor even to highly motivated women having superior ability. For example, assistantships in science have positive effects on the junior and senior science majors. It not only serves as a financial aid. it is interpreted as a "vote of confidence" and serves to increase interest, exposure and expertise in their areas. Assistantships also provide additional encouragement to go to graduate school, and usually provide a closer relationship with a faculty member. Assistantships to declared science majors may improve the retention rate and result in more women attending graduate school in science. Yet discrimination in granting fellowships is common. For example, consistently less than 3 percent of NASA fellowships go to women (about twice the rejection rate for females as males), and about 18.7 percent of NSF fellowships went to women in 1972-73 (Nies, 1976).

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*The Student Science Training Program sponsored by NSF has the basic goal "of providing talented students learning opportunities above and beyond those normally available in most formal science education programs" (NSF, 1975). Typically this involves high school juniors living on a college campus for a period of time during the summer.

B. Career Education

There are a virtual plethora of problems associated with current practices in career education. These include sex stereotyping of careers in literature and media, lack of awareness of alternative careers and lifestyles, sex-biased counseling, and so on. However, two appear to be especially relevant for science-related careers.

Increasing the education in science and math has many benefits for all women, whether or not they choose a career in these fields. It allows for greater perceived control of their environment, and provides them with a background adequate for a wide variety of careers. In the area of general career and science education, we recommend:

1. Differentiating between career education and programs to encourage women to choose science as a career. This conclusion is drawn from the recommendations to concentrate on women who have already expressed an interest in science and/or who have taken the necessary courses by the senior high level. However, some general encouragement may be necessary to obtain these prerequisites, e.g., prior to that time, career education courses for all students is important. Utilizing some of the media products and portions of the Kansas and Policy Studies Programs to make young women aware that science is a career option and to encourage them to obtain the necessary background (e.g., math and science) to keep those career options open is important prior to the senior high level. These programs could be done inexpensively, reach a large number of students, do not necessitate "special" programs for women, and become part of the career education classes in the school systems. These programs could incorporate the "lifestyle" considerations of a career.

2. Emphasizing the importance of continuing mathematics preparation. Since mathematics appears to be the "critical filter" to a wide variety of occupations it is imperative that females continue these courses in order to keep their career options open.

A great many methods in assisting women in mathematics are involved. These include developing innovative methods of teaching math adapted to the typical strengths of females, offering special tutorial/remedial courses, math anxiety counseling, and emphasizing an awareness of the effect of discontinuing math education.

C. Job and Educational Reentry Programs

Thirty-seven percent of women with children under six years of age and 50 percent of women with children between the ages of six and 17 were working in 1975. Since a majority of these women choose to remain out of the labor market for the first years after the birth of a child, these figures indicate that many women reenter the labor market after some period of economic inactivity. These women are typically re-employed in jobs that do not utilize their full potential, and jobs that typically are lower paying. This underemployment is more acute for the woman entering the labor market than for women who are continuously employed.

The woman attempting to reenter the labor market faces a multitude of problems and adjustments. First, her technical skills and theoretical understanding of her field may be outdated. This problem may be addressed by an additional educational experience. Second, her confidence in her ability to get or hold a challenging job may be diminished. She may not know how to interview for a job. She may have many logistical problems, such as arranging for child care, transportation and dinner each night. She may not have the support of her family and friends. She may be afraid of failure (or success). She may face very real discrimination on the part of employers. Consequently, the transition to work after a period of unemployment includes a dramatic change in lifestyle for herself and her family, and a change in her perception of her role.

After the childbearing years, many women want or need to reenter the labor market, i.e., they want to transition to work. For many women, this transition may include completing an advanced degree, or acquiring specific job related skills. Considering the underemployment and underutilization of the talents of these groups, the type of assistance given these women is important. Therefore, we recommend:

1. Concentrating on underemployed women. It is suggested that reentry programs for mature women might utilize already working, but underemployed, women. Updating the skills of women already in the labor force might alleviate problems in recruitment and placement. These women would have already adjusted their family arrangements to meet their work schedules, and have shown that they are motivated for employment. They may be currently underemployed, e.g., rather than capitalizing on their scientific skills, they may be working as secretaries, sales personnel or other jobs unrelated to their training. The major obstacle to this approach would be that their families may be accustomed to or dependent on the additional income, and a period out of the labor force to update their skills may impose an economic hardship for them, unless financial assistance is provided.

One successful approach is the current affirmative action program in the Food and Drug Administration. All males and females without opportunities for advancement are eligible for an on-the-job training and work release time for school in order to be qualified as an inspector. Normally a heavy science background is required for this position. The program enables advancement into a science-related career without initial salary penalty.

2. Considering employment prospects in the locale. It would appear logical to fund programs to update skills in areas where the labor demand is not abnormally low. That is, it is not cost-effective to prepare women for jobs that aren't available, and would be a discouraging experience for those women, and can elicit adverse community reaction among unemployed males and their dependents.

3. Funding projects to update job related skills. While these programs are typically expensive, it appears that some assistance to women to update their skills may be necessary. One of the side benefits of these programs may be that it allows for a more gradual adjustment to a working environment.

4. Making special seminars, workshops and counseling available. Since the majority of these women will have to make personal and familial adjustments to accommodate their new schedules, and job demands, special programs to help them overcome the perceived barriers and obstacles associated with employment could help to increase the success rate of these reentry programs. That is, a woman's ability to get and hold a job, even though she has adequate skills, may be dependent on her attitudes and motivation for work, i.e., her job readiness. It is recommended that assistance in developing an appropriate job readiness profile be a component of all reentry programs.

D. Administrative Recommendations

1. Improving the quality of the experimental research. There are several ways to attempt to improve the quality of the research. These include (a) more selective funding, (b) providing technical assistance, and (c) use standardized measures and long-term follow-up.

a. *More selectivity in funding*. Overall, the quality of the projects, as experiments, could have been improved. One factor was the circulation of the announcement of the availability of support for these projects. Most of the project directors reported learning about the program from the flier received at a dean's office. Consequently, only a very few proposals were received and very few requests for funding were rejected. A better mechanism of disseminating information to prospective applicants should be developed.

A concomitant observation is the difference in results obtained by experienced researchers and those with less experience in experimental design. That is, all of the project directors appeared to be committed to increasing career options for women, and to have strong backgrounds in science. Most, however, did not have an extensive background in experimental design and evaluation, adequate knowledge of control group procedures and statistical analysis. The results of only two projects, although not confirming the hypothesis, allowed some degree of confidence in the outcome. However, there are many benefits to providing a wide spectrum of individuals. These include increased capability by personnel to conduct such projects, increased commitment to women's projects, and possible beneficial effects to the participants. Therefore, a conscious strategy should be developed regarding the importance of reliable experimental results. Should it be decided that confidence in the experimental results is important, some percentage of the project directors should have a demonstrated capability in project management, experimentation, and evaluation.

b. Providing technical assistance to the project directors. NSF has traditionally adopted a "hands-off" policy to grantees. While this policy has many advantages, providing technical assistance in evaluation procedures and instruments to those project directors requesting it might mitigate against the technical problems encountered in many of the projects.

If the current "hands-off" policy toward grantees is maintained, a brief project directors handbook, containing a description of commonly occurring barriers to the implementation of both the project and the experimentation/evaluation is recommended. The case studies do not serve this purpose well because (1) the case studies are too long, (2) are not necessarily perceived as relevant to project needs, and (3) may not be fair to the individual project reviewed, since they were written for other purposes.

This booklet could contain, for example, an overview of problems encountered when dealing with recruiting, working in the public school systems, or in developing evaluation instruments.

c. Using standardized evaluation tools and long-term tracking. If experimental projects are to be continued to encourage women to choose science-related careers and the independent measure is a questionnaire of any kind, the evaluation team recommends that reliable and validated instruments be provided for use by the project directors. Each of the projects has designed at least one such instrument, and the best items could be chosen and validated from this pool or one of the better validated ones, such as that used by ACT, could be used. It is felt that a standard unit of measurement could be developed for all similar projects. Even if a project wanted to have additional dependent measures, at least a comparison, either of the project outcome or its evaluation methodology, would then be possible. It is recognized that a single instrument may not be appropriate for all types of experimental designs and that the use of a validated instrument will insure neither superior experimental nor evaluation procedures.

2. Coordinating intergovernmental activities and delineating activities. There are several federal agencies currently working in the area of career education with some emphasis on women. These include the Women's Educational Equity Act (OE/HEW), Education and Work Group (NIE), Office of Career Education (HEW), and the American Association for the Advancement of Science, Office of Opportunities in Science. Ideally, full sharing of resources should occur. In addition, some agreement about areas of concentration might be possible. For example, NSF might focus on high ability women interested in science, and only assist Office of Career Education in making younger women aware of nontraditional career opportunities. Further, OE/HEW is already planning dissemination activities for similar programs and NSF could add their material to this clearinghouse.

3. Continuing experimental activities by NSF and disseminating knowledge about its programs. In addition to the increase in knowledge gained by the experimental projects, the team has observed some psychological benefits just from the existence of the program. Even the participants commented that they were impressed that "somebody" was interested in their careers. Further, in the current climate of the women's movement and the possible defeat of the ERA, the existence of federal interest and support is imperative for the morale of the people committed to career/life options for women. However, the evaluation team feels that a great many benefits in formulating effective policy would be derived by continuing in the experimental mode, both to NSF, as well as to other agencies. That is, building on the present experience could enhance knowledge about effective methods of implementation.

4. Including specific programs for minority women. In neither the women's projects, which typically contained no minority women, nor in the minorities projects, where women subjects were not identified, were the special problems of minority women addressed. It is recommended that minority women should be given special attention and special programs should be initiated if they continue to "fall between the cracks" of existing programs (cf. Malcom, 1976).

5. Attending to continuity/institutionalization of funded efforts. Ideally, there should be no need for women's offices and programs as separate entities, e.g., these efforts should be incorporated and integrated into every level of the existing structures. Further, one specific aim of research/demonstration projects is their continuation by the institution in the absence of special funding. In order to facilitate both continuity and institutionalization

we recommend special attention to utilizing existing and ongoing structures as a basis for these activities, such as sororities of black women, professional associations, PTAs, etc. Where these are not available, the program should be cognizant of continuation problems prior to initiation, and should plan to "institutionalize" the program. One way of doing this is to make the program concretely benefit the parent institution (e.g., increased enrollment, increased visibility, legal compliance, etc.).

6. Disseminating the developed materials. Some of the projects have engaged in fruitful activities to disseminate their "products." These appear to be successful. However, since these have occurred through different outlets, a compilation of these activities might be produced by NSF. Several projects overlapped in the materials developed (e.g., Policy Studies and Kansas) and other project products (e.g., the film and media packets) could be used co-jointly in the context of other programs. A compilation of all projects designed to encourage women to choose science as a career could be an aid to science teachers and career educators to choose the material most appropriate for their classes. These materials could be made available to a variety of clearinghouses, public libraries and school libraries.

7. Investigating additional intervention strategies. We also recommend experimental investigation of several areas not covered by these projects. These are the study of the effects of aggregation, males in science establishment, and the effect of "significant others," including peer and social group pressure.

a. *Systematic examination of the effects of aggregating women students*. A recent article in Science (Tidball and Kistiakowsky, 1976) reported that the undergraduate institutions from which women have gone on to receive doctorates are different from the institutions preparing men for doctorates. The authors concluded that "women who subsequently received doctorates were more likely to have graduated from institutions that enroll large numbers of women students, had a long and continuous history of women graduates who attained doctorates and offered strong academic preparation in several areas of study." Since many schools enrolling women offer strong preparation in several areas, the distinguishing characteristic of these institutions preparing women for nontraditional roles appears to be their long and continuous history of female representation.

To describe the effects of grouping a certain proportion of these women, a construct might be developed involving "critical mass" or "critical proportion." The construct implies that once this number or proportion is reached, the recruitment and retention of the group becomes a self-sustaining and self-perpetuating system.

Once a critical number or given proportion of women participate in a nontraditional activity, an examination of the need for special recruiting/retention programs should be performed. In fact, it may result in an ever increasing rate of participation.

Conversely, another investigation should determine whether the absence of the critical number or percentage may produce a situation where efforts must be continuously expended to recruit and retain these groups, since the history of unsuccessful participation acts as a discouraging factor, e.g., as the retention rate drops because of a feeling of isolation, fewer will be attracted.

b. Systematic examination of attitudes of males. There is undeniably still a great deal of overt and covert discrimination against women pursuing science. The guardians of the profession are predominantly male. We recommend examination not only of the attitudes of the male science establishment toward females in these professions, but the circumstances that could occur to influence their attitudes toward the participation of women. Dr. Janet Brown, head of the Office of Opportunities in Science at AAAS, has strongly suggested that such research be conducted by an eminent male scientist.

c. Examination of the effect of significant others on women. Since the problems involved in occupational segregation are similar to normative deviance, we recommend examining the influence of:

- parents
- school personnel
- male peers
- female peers

Admittedly, a multitude of studies have attempted to examine the most important influences on female scientists. Unfortunately, most of them have been retrospective; e.g., asking women to recall what was important to them 20 years ago. This type of research has several disadvantages: perspectives change over years, especially regarding events that were not consciously considered at the time. Examination of these factors in real time would be more advantagous, and might, as in the ACT study, indicate important changes in perceptions over years. Further, several of the present experiments included these groups, but none was successful in gauging their impact on the female students. If these are successful, the long range benefits of these programs would likely be more cost-effective.

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APPENDICES

APPENDIX A

ALTERNATIVE INTERVENTIONS

ALTERNATIVE INTERVENTIONS

There are many barriers to account for the lack of participation by women in nontraditional science careers. These psychological, sociological and institutional barriers have been systematically laid out by Dr. Smith at the University of Kansas (1976). His delineation of the barriers is given in Table 1.

There are a wide variety of interventions or treatments which may serve to overcome these barriers and to encourage women to choose science-related careers. These vary by age group, comprehensiveness and area of focus. Generally speaking, programs for young women may be considered career education and are less specific to science. Further, programs offered in earlier years may be considered as recruitment, while programs for college age may concentrate on support and retention.

Many of the potential programs listed below are not within the charter constraints of the National Science Foundation. Because it is felt that a sustained effort, reaching each female as continuously as possible throughout her formative years, may be necessary to counteract society's socialization processes, many programs are listed.

The list of programs is divided by educational level. The assumption underlying these programs is given first. The list is not complete, and is intended to act as a "working draft," and is laid out in Table 2.

TABLE 1

Barriers Proposed as Affecting Career Choice of Women

Role Conflict (Career Person versus Parent)

1. Women feel a long-term commitment to a career interferes with raising preschool children.
2. Women feel a long-term commitment to a career interferes with raising a family.
3. Women feel that their basic responsibility is raising the children in our society.

Role Conflict (Career Person versus Spouse)

4. Women feel that a husband's success is more important than a wife's success.
5. Women feel they should adjust their career goals in order not to interfere with their husband's success.
6. Women are not free to move to new locations as career opportunities open in their field.
7. Women feel a strong career commitment interferes with a happy marriage.

Family's and/or Friends' Opposition to a Career

8. People who are important in a woman's life (that is, family and friends) believe a woman's place is in the home.
9. People who are important in a woman's life (that is, family and friends) do not think it is appropriate for a woman to pursue a professional career.

Lack of Opportunity (in Jobs)

10. Women who are trained in science fields do not have as many job opportunities as men.
11. Women have not been informed of job openings in traditionally male science careers.
12. Women are not as aware as men of the variety of available science careers.

Lack of Opportunity (in Education)

13. Women with math and science ability do not have the same educational opportunities as men. For example, women have more difficulty getting into medical school than men.
14. Senior high women are discouraged from pursuing the science and math courses which would prepare them to pursue science majors in college.

TABLE 1 (Continued)

Fear of Success

15. Women fear the consequences of being highly successful in their careers.
16. Women do not want jobs that involve professional responsibility and commitment.

Lack of Professional Support

17. Women scientists are out of the mainstream of important professional contacts.
18. Women who are scientists are not supported and not kept informed by fellow professionals. For example, women do not receive up-to-date information about research possibilities.

Perceived Lack of Ability

19. Women do not feel competent enough in math and science areas.
20. Women believe the stereotype that they do not have a natural bent for solving problems and therefore do not have a natural ability to be scientists.

ALTERNATIVE INTERVENTIONS
TABLE 2

Assumption	Elementary School Programs	High School	College	Graduate	Reentry	Post Employment
Knowledge that science-related careers are open to women is a prerequisite for pursuing those careers	1. Use of nonsex stereotyped depicting of occupations in printed material 2. Programs to reach elementary school teachers and administrators 3. Efforts to eliminate current sex role specialization in school systems	1. Use of nonsex stereotyped depictions of occupations in printed matter and "career day" programs 2. Programs to reach high school teachers, administrators, and especially counselors 3. Efforts to eliminate current sex role specialization in the school systems	1. Workshops and seminars portraying professional women in science careers 2. Increase in number of female science professors			
Many women capable of pursuing science-related careers lower their aspirations because of peer and parent pressures and concern for popularity and future familial relationships		1. Making males and females aware of career alternatives 2. Making males and females aware of satisfying nontraditional family relationships 3. Encouraging young women to discuss career options with their parents				

TABLE 2
(Continued)

Assumption	Elementary School Programs	High School	College	Graduate	Reentry	Post Employment
Many women fail to pursue science-related careers because they fail to successfully complete prerequisite mathematics preparation		1. Programs emphasizing long-range planning including continuation of mathematics 2. Innovative methods of teaching math adapted to the strengths of females 3. Special tutorial programs	1. Remedial math courses 2. Innovative teaching methods 3. Special tutorial programs			
Career committed females may benefit from special counseling support group activities		1. Identification of career committed females	1. Special counseling and support groups 2. Special housing			

TABLE 2
(Continued)

Assumption	Elementary School Programs	High School	College	Graduate	Reentry	Post Employment
Tangible and intangible institutional barriers discourage women from pursuing science-related careers			1. Increasing number of undergraduate assistantships 2. Increase women in coop and intern programs 3. Rewriting "fellow"ship brochures 4. Increase female faculty	1. Provide more financial aid 2. Adapt financial aid provisions to meet the needs of women 3. Increase in number and status of female faculty 4. Special programs to encourage Ph.D. completion		1. Repeal of anti-nepotism rules 2. Tenure and fringe benefits for part-time employment 3. Split positions and flexible hours 4. Equalization of pay scales
Women reentering labor market have special needs					1. Programs to update previously learned skills 2. Special counseling programs 3. Assistance in job placement	

TABLE 2
(Continued)

Assumption	Elementary School Programs	High School	College	Graduate	Reentry	Post Employment
Women beginning or continuing formal education in their mature years have special needs					1. Special vocational guidance programs 2. Use of CLEP and related programs 3. Increase in assistantships 4. Increase in coop and intern programs	
Increasing the awareness of the status of women by the working community will (1) increase job satisifaction, (2) increase the number of females in the labor force, and (3) may alter the stereotypes that employees convey to their children						1. Workshop/seminars of employees on the status of women 2. Soliciting industrial support for women's programs

APPENDIX B

SITE VISIT OUTLINE

Institution:

Project Number:

Principal Investigator:

Original Design of Experimental Project

A. Rationale of project designed:

B. Stated objectives (hypotheses):

C. Independent variables (treatments):

D. Dependent measures:

E. Sample:

	Experimental	Control
1. age		
2. number		
3. ability in science		
4. interest in science		
5. sex		
6. other variables (ethnic, suburban, etc.)		
7. recruitment procedures		

Project Implementation

A. Changes in rationale (if any):

B. Changes in goal (if any):

C. Any other procedural deviations (schedules, etc.):

D. Actual sample

	Experimental	Control
number contacted		
number participating		
number (%) completing (retention)		
factors influencing participation and/or attrition		

Participants

A. Describe any distinguishing characteristics not covered by "sample":

B. Other comments:

Project Personnel

Total number of personnel interacting with participants

A. Scientific background:

B. Commitment to open career options:

C. Perceived attractiveness by participants:

D. Perceived credibility by participants:

E. Motivation for instituting project:

F. How heard about program:

G. Sex of personnel:

H. Other comments:

Type of Communication

1. Modalities (print, etc.):

2. Format (sequence of presentations, etc.):

3. Actual content (realism, etc.):

4. Relevance of content to background of participants:

5. Number of disciplines discussed:

6. If more than one type of communication was used, which type was most effective?

7. Which (content area) of each type of communication had most impact:

8. Comments:

Institution

1. Type of school (liberal arts, etc.):

2. Geographic location:

3. Degree and type of institutional support and commitment at program inception:

4. Adequacy of facilities for conducting the project:

5. Possibility for program continuation in absence of NSF funding:

6. Institutional ratio of males/females:

7. Comments or distinguishing characteristics:

8. Attitude changes with institution members because of the program:

9. Behavioral changes in institutional members because of program:

Cost Variables

1. Total cost per participant $\left(\frac{\text{number participants}}{\text{total budget}}\right)$

2. Cost and time to prepare course materials:

3. Cost to administrate $\left(\frac{\text{program cost-cost to prepare}}{\text{number of participants}}\right)$

4. Cost to use if number of participants were increased:

5. Cost to reuse with same number of participants:

6. Time commitment by participants:

7. Cost in comparison to alternative, similar programs:

Overall Evaluation

A. Program Conception

1. Appropriateness:

2. Validity and utility in meeting needs:

3. Quality:

4. Priority in face of competing needs:

5. Adequacy of experimental design:

B. Need for Program

1. Number of people applicable to:

2. Intensity of need of appropriate participants:

3. Projected demand for program at other institutions:

4. Projected support for program (source):

Global Effectiveness of Program

1. Short term changes:

2. Anticipated long term changes:

3. Goal attainment

4. Obstacles in conducting program:

5. Suggested changes if program repeated:

6. Most effective program component:

7. Least effective program component:

8. Most effective combination of components:

9. Generalizability and replicability of program:

10. Dissemination of materials:

11. Comments:

APPENDIX C

PARTICIPANT IMPACT SURVEY AND SAMPLE COVER LETTER

COLORADO SEMINARY
UNIVERSITY OF DENVER
DENVER RESEARCH INSTITUTE
UNIVERSITY PARK • DENVER, COLORADO 80210

Industrial Economics Division

June 9, 1976

xxxxx
xxxxx
xxxxx

Dear Ms. :

In the summer of 1974 you participated in Summer Engineering for Women at the University of Oklahoma. That project was funded as part of an experimental program. The Denver Research Institute is conducting a study to examine the impact of these projects, and to recommend the kinds of projects that best serve to encourage women to choose math, science or engineering as a career.

We would appreciate it if you could take a minute to fill out the enclosed postcard to help us in our efforts to recommend the most effective projects for women.

Sincerely,

Alma Lantz, Ph.D.
Research Psychologist
Industrial Economics Division

Enclosure

PROJECT NAME

		YES	NO
1.	I am now taking a math or science class . . .	[ ]	[ ]
	I most likely would have without program. . .	[ ]	[ ]
2.	I am now planning on a career in math/science	[ ]	[ ]
	I most likely would have without program. . .	[ ]	[ ]
3.	I am now planning on a different career as a result of the program	[ ]	[ ]

4. The most positive aspects of the program were:

5. The less influential aspects of the program were:

COLORADO SEMINARY
UNIVERSITY OF DENVER
DENVER RESEARCH INSTITUTE
UNIVERSITY PARK • DENVER, COLORADO 80210

Industrial Economics Division

Dear "project director":

We are enclosing a copy of the "independent impact survey form" that we have sent to the list of participants that you gave and a copy of the cover letter accompanying the form. We do not feel that the questions on the postcard will be objectionable to you.

We also have one final favor to ask. We have enclosed a copy of the summary sheet we are using for each project. We would appreciate it if you could also complete it and return it to us as soon as possible. Your response may add fresh insights into our observations and will correct any errors we might have made. If you have any questions, please call us collect at either 303/753-3376 or 753-3301.

We really appreciate your time in this last request.

Sincerely,

Alma Lantz
Industrial Economics Division

AL:tk
Enclosure

cc: Dr. Anita West
Ms. Joan Callanan

APPENDIX D

SELECTED EXISTING ALTERNATIVE CAREER PROGRAMS FOR WOMEN

SELECTED EXISTING ALTERNATIVE CAREER PROGRAMS FOR WOMEN

Special Programs for Women

The Women's Center
Barnard College
606 W. 120th Street
New York, NY 10027
Contact: Jane Gould
212/280-2067

The Women's Center at Barnard College devotes itself to reaffirming the dignity, autonomy, and equality of women. The Women's Center hopes to contribute to the dialog about the problems, the place, and the potential of women in contemporary life; to help develop new bonds between a college and women away from college; and to give fresh insight for undergraduates about what it means to be a woman in modern times. They maintain resource materials for the students on options and the various careers available to them.

Wider Opportunities for Women Center
1649 K Street, 4th Floor
Washington, D.C. 20006
Contact: Nancy Rigby, Betsy Cooley
202/638-4868

Formerly called the Washington Opportunities for Women Center, this women's center has been in existence for ten years as an information and career counseling center. They have recently begun publication of Women's Work, with which they are expanding their services to provide sources for practical news and ideas about job realities for women. The main thrust of the Center is toward job counseling and training aimed at integrating women into the workforce more equitably. The Center provides job counseling for professional women and has extensive programs enabling women to obtain vocational job training and placement in both traditional and non-traditional fields. In these programs, they not only help obtain training and placement, but also help to sensitize supervisors, management, fellow workers and the women themselves to what they can expect especially with women in non-traditional careers. The Center is presently trying to organize a coalition of similar programs across the country to share and exchange information and resources.

Business and Professional Women's Foundation (BPW)
2012 Massachusetts Ave., N.W.
Washington, D.C. 20036

BPW Foundation will start a revolving loan fund for women engineering students to assist women in obtaining graduate engineering degrees. This program was announced recently by the Business and Professional Women's Foundation. The Exxon Education Foundation made a $100,000 grant to the Foundation to assist in starting the program. "Only one percent of the professional engineers in this country are women," said Maxine R. Hays, President of the BPW Foundation Trustees. "Women are only five percent of the enrollment in engineering degree programs. The BPW Foundation is encouraging more women to become engineers and one important way that this can be accomplished is to make financial assistance available." Loans amounting to $70,000 annually will be made to women accepted for masters' level study at universities accredited by the Engineers Council for Professional Development. Working with the Society of Women Engineers, the BPW Foundation will distribute information about the loan program to engineering schools and women who are presently employed in engineering fields or who are undergraduate engineering students. A selection committee to review applicants for engineering study loans will include representation from the Foundation, the Society of Women Engineers and the general public. Loans up to $2,000 for one year will be granted.

Women's International Information and Communication Service (ISIS)
Via della Pelliccia 31
00153 Rome, Italy
Contact: Judy Sidden
ISIS
1915 Glenwood Ave.
Raleigh, NC 27608

A new Women's International Information and Communication Service has been organized to serve the world-wide feminist community. The four primary goals of ISIS are information dissemination and documentation, information organization, continued dialogue about women's issues on an international basis and coordination and cooperation among women on projects of an international concern. The work tasks are viewed in two main categories--information organization and dissemination and the development of communication networks among women. Among the proposal planners and endorsers of ISIS are Brigalia Bam, head of the Women's Desk, Unit III, World Council of Churches; Sylvia Talbot, Episcopal Supervisor, African Methodist Episcopal Church; Jessie Bernard, sociologist, National Institute of Education; Robert Cramer, Director of Resources for Communication and Elise Boulding, sociologist, Institute of Behavioral Science, University of Colorado.

Women Doing Research
American Psychological Association (APA)
Workshop conducted by Committee on Women in Research
Susan Sacks, Barnard College
Reesa Vaughter, Fordham University

This APA workshop was designed to communicate and utilize each participant's resources, and attempted to share expertise, ideas and strategies. Participants in the workshop articulated barriers to research achievement and strategies for overcoming those barriers. The purposes of the workshop were to (1) identify internal (psychological) and external (institutional and social) barriers to the productivity, achievement, personal satisfaction, and professional development of women researchers; (2) to exchange information concerning developed strategies which are effective against these barriers; (3) to initiate a network of communication among women researchers; and (4) to communicate participant recommendations and suggestions for action.

Introduction to Engineering Program for High School Girls
College of Engineering
University of Wisconsin
Madison, Wisconsin 53706
CONTACT: Lois B. Greenfield
608/262-2473

The Introduction to Engineering Program for High School Girls is a summer program "designed to introduce qualified high school women to facets of the engineering profession and to encourage them to consider engineering as a career." Eligibility for the program requires three years of high school, two years of high school math, one year of science beyond general science, and academic standing in the upper 20 percent of the student's class. Applicants who had a great deal of knowledge about engineering through participation in similar programs were not generally accepted into the program.

The program involves a one-week in-residence introduction to the specific fields of engineering offered by the college. This introduction took the form of lectures and tours of facilities by members of the college facilty, and literature pertinent to the specific fields. Extensive use was made of realistic role models and hands-on experiences. (The women were able to program a computer, make castings in the foundry, etc.)

Extensive background information was taken on each woman and questionnaires were filled out by the students both before and after the course. An attempt was made to determine the significant factors in creating an awareness of or an interest in science fields, not only within the program but also in the student's home or school environment.

Suggestions from participants for improving the program included having more tours and demonstrations; having more "doing" experiences, as opposed to passive listening; involving engineering students more actively in the presentations; and encouraging speakers to communicate more at the level of the participants so they may be more easily understood.

The program's evaluation "tends to indicate that for these select young women, a program such as this is influential in helping young women choose an engineering career."

Operating funds for the program are supplied by the University ($25 per student) and each participant contributes $25 toward dormitory housing and meals for the week.

Math for Girls
Lawrence Hall of Science
University of California
Berkeley, California 94720
CONTACT: Nancy Kreinberg
415/642-4193

Math for Girls is a program involving eight-week tuition courses with the purpose of introducing girls to hands-on experiences in logical thinking and problem solving to stimulate their curiosity and interest in mathematics. Puzzles, games and computer activities show a side of mathematics that can be fun as well as challenging.

Stimulus for the program came from the low enrollment of female students in the Hall's classes in physical and life science, computer science and mathematics. The courses are taught by female students at the University who are enrolled in mathematics and computer science. They are selected and trained on the basis of their interest and ability in mathematics, and their desire to act as role models of women in mathematics for their students.

Throughout the course, time is set aside for discussion of girls' competency and interest in science and mathematics, and the stereotypic attitudes that can result in limited career expectations for women. The importance of electing science and mathematics courses in high school is stressed, since avoidance of such courses severely restricts an individual's choice of college major.

The program is still experimental and does not as yet have an evaluation process built in. Presently, they have no funding outside the University, but are seeking such funding to enable them to not only evaluate effectiveness but also bring Math for Girls to the larger Bay Area community by providing after-school workshops in selected areas.

Simmons College
Boston, Massachusetts
CONTACT: Ann Bryant
617/238-0410

Simmons College has a program funded by a large grant from the Carnegie Foundation for women employed in the banking industry. This program is directed toward women who do not have B.A. degrees and is designed to teach management principles and give them skills needed to succeed in the banking industry. The course consists of weekend seminars leading to a B.A. degree.

Project Equality--Expanding the Occupational Perceptions of Girls
Highline School District #401
15675 Ambaum Boulevard Southwest
Seattle, Washington 98166
CONTACT: LaRae Glennon
206/433-2365

The goal of this program, which deals with both secondary and primary students, is to expand the occupational perceptions of girls. Their objectives in attaining this goal include developing occupational simulations for the primary grades (to demonstrate both sex's abilities to perform these occupations); career exploration experiences, including speakers and simulation experiences, for girls in the secondary grades; developing packets of activities which suggest practical techniques of countering sex-stereotyping (role playing, role reversal); and developing a bibliography of nonsex biased and female role model books.

The program has evaluation instruments designed to assess perceptions of occupational opportunities available (with regard to sex) and indications of sex-role stereotyping. Five different instruments were used to evaluate the programs of five grade levels.

Evaluation of the primary and secondary level programs showed that significant gains were made in expanding student's perceptions of occupational opportunities available to females and a reduction in instances of sex-role stereotyping. Additionally, initial evaluation results of secondary level programs suggest an increased knowledge of the participation of females in society.

The project's first year was funded for over $70,000 by the State of Washington under Title III of the Elementary and Secondary Education Act of 1965.

Department of Mathematics and
Computer Science
Mills College
Oakland, California 94613
Contact: Lenore Blum
415/632-2700

This program, which is funded in part by the San Francisco Foundation, was begun in order to increase mathematical and technical expertise of women in many fields. A key feature is to provide easy access into the mathematics program at Mills College. Their methods include stimulating interest by weekly seminar series featuring invited speakers (predominantly women); redesigning math courses so that those with only limited high school background would not be deterred; designing a network of workshops to deal with additional student needs and to provide a variety of entrance points to the program; providing early career experiences; and increasing awareness of career options.

Evaluation of long-term effects is anticipated but not yet started.

Women and Careers in Traditionally Male Fields
Institute of Technology
University of Minnesota
Minneapolis, Minnesota 55455
Contact: Sandra Davis
612/373-2851

This two-year-old program offers a credit course to meet the needs of women entering traditionally male career fields, including engineering, medicine, dentistry, veterinary medicine, architecture, mathematics, computer science and law. The program makes extensive use of role models allowing participants the opportunity to listen to professional women's experiences and asking them questions of what life, pay, and work is like in professional careers. In choosing role models, the program looks for diversity of life styles and occupations as well as age.

The program as yet does not have a formal evaluation, but in terms of numbers of women students enrolling in the Institute, the program appears to have had an impact as the number has almost doubled.

Catalyst
14 East 60th Street
New York, New York 10022
CONTACT: Miriam Krohn
212/759-9700

Catalyst is a national nonprofit organization which develops and expands career options primarily for college-education women, with some programs for undergraduate women and women re-entering the work force. The group provides career information and self-guidance material; helps the employed woman respond effectively to opportunities for upward mobility; assists employers with the recruitment, assimilation and upward mobility of women; interprets the needs of the marketplace and offers services to equip women to meet those needs; and maintains information for referral to a national network of resource centers for women. They also publish the National Roster monthly. This roster is a computerized listing of professional women seeking employment and is distributed to employers nationwide.

Options for Women, Inc.
8419 Germantown Avenue
Philadelphia, Pennsylvania 19118
CONTACT: Marcia Kleiman
215/242-4955

Options for Women is a nonprofit corporation consultation service for women seeking to expand their career options. Modest fees are charged to cover their operating expenses and vary according to the service.

Their purpose is to aid women in defining and clarifying their career goals and explore the options available to them; they also help the community consider alternative career patterns, recognize the varied abilities of women, and create more varied opportunities for women.

The program includes individual and group consultations, vocational interest and aptitude tests, a resource library, a placement service, and a consulting service to aid employers and institutions in issues dealing with issues regarding the hiring and promotion of women.

Maple Heights Equity Career Education Program
Maple Heights City Schools
5500 Clement Drive
Maple Heights, Ohio 44137
CONTACT: Marilyn Hormann
216/587-3200, Ext. 200

The objectives of this program are to give learners in grades K through 10 an increased knowledge of careers so that they may make more informed decisions, and make students (especially female) more aware of equity and the fact that existing sex bias and sex stereotyping limit career choices and career goals, so they will be challenged to consider alternative roles and career models.

The program utilizes classroom activities, as well as activities with parents, the community, and business and labor leaders.

An evaluation (by consultants) will be completed by May 1976 and will determine the change in student's attitudes toward career choices and goals. The program has been funded by a $131,000 grant.

Sandia Laboratories
Albuquerque, New Mexico 87115
Contact: Charles E. Cockelreas
505/264-1130

Sandia Laboratories, a prime contractor to the U.S. Energy Research and Development Administration, has produced three films on science and engineering. The first two films dealt with Chicano and Indian Ph.D.'s in science and engineering. The third film is the first in a series of 6-8 films about women in science and engineering. The first of this series is . . .keep the door open. This film and the rest of the series have the goal of encouraging young women to consider careers in science and engineering and are directed toward junior high school girls. The thrust of all the films will be to provide role models that counteract existing stereotypes. Interviews were conducted throughout the country to find articulate women of varying physical and intellectual types. Although the films obstensibly deal with the professional side of science and engineering careers, there is also considerable discussion about the kinds of problems the women faced as girls growing up in a traditionally conservative culture.

Building Effective Minority Programs in Engineering Education
Committee on Minorities in Engineering
Assembly of Engineering
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

This report is the first of a series on minority programs in engineering education. The committee's work is aimed at increasing the representation of American Indians, Black Americans, Mexican Americans, and Puerto Ricans in the engineering professions. They hope to accomplish this by providing effective national leadership and coordinating the various activities best calculated to advance minority group participation in historically underrepresented engineering professions. The Committee is made up of representatives from engineering schools and societies, racial and ethnic organizations, industry and government.

Women in Science and Technology: Careers for Today and Tomorrow
The American College Testing Program
P.O. Box 168
Iowa City, Iowa 52240
Contact: Dale Prediger
319/356-3711

This publication is intended to provide information for women on careers in science and technology. Comments from numerous women already established in their fields provide some insight to what it's like to be a scientist or engineer as well as problems encountered in being a woman in traditionally male fields. The booklet examines the many varied fields of science and technology including suggestions on steps young women can take to plan a successful career.

Math Learning Center
Oregon Mathematics Education Council
325 13th St., N.E., Room 301
Salem, Oregon 97301
Contact: Barry Mitzman
503/378-3175

The Math Learning Center is an experimental program to improve math education in Oregon with support from the National Science Foundation. The program is designed to allow teachers to approach mathematics instruction through nontraditional methods. Another program in the system offers in-service workshops for teachers, and has established math resource centers. The Council publishes two periodicals: The Oregon Mathematics Teacher and the Math Learning Center Report.

The Spokeswoman
53 West Jackson, Suite 525
Chicago, Illinois 60604
Contact: Karen Wellisch
Editor and Publisher

This monthly newsletter reports news about women not usually covered by the established mass media. They include news about education, employment, politics, legislation, legal action, welfare, etc. Their objective is to inform women about what other women and women's organizations are doing all over the country to win equal rights and open new opportunities.

Federation of Organizations for Professional Women

Executive and Research Office
828 Washington Street
Wellesley, Mass. 02181
617/235-8624

Governmental Information Office
1346 Connecticut Avenue, Room 1122
Washington, D.C. 20036
202/833-1998

The affiliates of the Federation coordinate their energies and activities to increase women's intellectual and economic independence and to advance women in the professions. The organization is working to attain equal status in professions and occupations for all women; equal access to training, funding for research, and policy appointments; equality in hiring, pay, benefits, and promotions, as well as entrance into professions at all levels; and the sharing of expertise to promote effective national policy on the status of women.

APPENDIX E

FILM BIBLIOGRAPHY

FILM BIBLIOGRAPHY

Title: And Who Are You?
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Hubert S. Coffey and Marya Mannes discuss discovery of one's inner self and the possible conflicts in maintaining one's individuality. One of the series, Choice: Challenge for Modern Woman.

Title: Choice Chance Woman Dance
44 minutes, color, 1972
Filmmaker: Ed Emshwiller
Description: Purports to "tackle the dilemmas, paradoxes, and choices available to the middle class woman today . . ."

Title: Girls and Women
A series of 10 programs of 30 minutes each
Filmmakers: Selma Odom and Margo Shackson
Producer: The University Television Center
Description: A series which focuses on the physical and sociological differences between the sexes, the psychology of women, variations of life styles, women's place in history, stereotypes of women and women's rights.

Title: Is Personal Growth Selfish?
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Sister Mary Corita, and Anne Steinmann discuss women's growth throughout life, their dependency upon male and societal attitudes, and opportunities with "the system." One of the series, Choice: Challenge for Modern Woman.

Title: Margaret Mead
30 minutes, B/W, 1960, #6930
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Celebrated anthropologist brings the experience and understanding gained from her study of primitive cultures to a lively discussion of contemporary world problems--marriage and morality, the place of women in modern life, the education of young people, etc.

Title: Woman's Place?
30 minutes, 16mm, B/W
Source: American Association of University Women/2401 Virginia Avenue, N.W./Washington, DC 20036/phone 202-338-4300
Description: AAUW panel discussion by six women on the status of women.

Title: A Woman's Place
A weekly program series on WTTW Ch. 11. Production started in February 1972, and broadcasting began shortly thereafter.
Description: Focuses on the changing role of women in today's world. The program is designed as an open forum for the exploration and discussion of the full spectrum of viewpoints concerning women's issues.

Title: 51%
30 minutes, 16mm, color, 1971
Directed by Dick Feldmen, produced by Rob't Drucker & Co.
Source: Sheldon Satin Films/1175 York Avenue/New York City, NY 10021
Description: Three case studies of women employees in a corporation spotlight stereotypes about and discrimination against women. Provides good role-model examples for women dealing with difficult situations.

*Title: Help Wanted - Women Need Apply
61 slides with script
Source: Jim Farron/Dallas Regional Office/Civil Service Commission/ Dallas, TX
Description: Designed to be shown to high school and college classes and women's clubs, the film describes and shows women in a variety of jobs--flood control engineer, attorney, chemist, accountant, radio equipment installer and repairer, photographer, and others.

Title: Job Interview - Three Young Women
17 minutes, B/W, 1968
Source: Business Education Films/5113 16th Avenue/Brooklyn, NY 11204
Description: Three young women are interviewed for a job. The discussion centers on mistakes they make during the interview for a job, and how to correct them.

Title: Never Underestimate the Power of a Woman
20 minutes
Source: Norma Briggs/Department of Apprenticeship Training/ 310 Price Place/Department of Labor, Industry and Human Relations/ Madison, WI
Description: A film showing women performing well in so-called male occupations.

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*Films dealing specifically with women in science.

Title: Modern Women: The Uneasy Life
55 minutes, 16mm, B/W, 1963
Source: University of Indiana
Description: Faces with candor--the feelings of both women and men regarding the traditional role of women. The new freedom involves multiple choices which create anxieties. Participants include young married women, college women, career women.

Title: What Is A Woman?
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Keith Berwick and Margaret Mead discuss what is feminine and masculine, as prescribed by society and confused by changing patterns. One of the series, Choice: Challenge for Modern Woman.

Title: What Is The Shape Of Tomorrow?
30 minutes, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Jeanne Noble and Rabbi Alfred Gottschalk discuss variation in personal standards, beliefs, and values; spiritual, moral and interpersonal sources of strength; and women's power in shaping the world of tomorrow. One of the series, Choice: Challenge for Modern Woman.

Title: Who Wants Freedom?
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Elisabeth Mann Borgese and Richard Lichtman discuss the meaning and consequence of "freedom" . . . how much self-determination and in what areas of life? One of the series, Choice: Challenge for Modern Woman.

Title: Woman Is
27 minutes, color, 1969
Producer and Source: American Standard Association/10 E. 40th Street/New York City, NY 10016
Description: Examines the personal philosophy of the woman in today's world and shows her in some of her many roles, as an enigma, a philosopher and a romantic.

***Title:** . . . keep the door open
19 minutes, 16mm, color
Filmmaker: Charles E. Cockelreas
Source: Motion Picture Production Division-3153/Sandia Laboratories/Box 5800/Albuquerque, NM 87115
Description: Film designed to encourage young women to "keep the door open" on career options and to consider non-traditional careers, especially math and science. Discussions of life and work with numerous professional women involved in non-traditional careers.

Title: New Careers for Women
17 minutes, color
Source: American Educational Films/331 North Maple Drive/
Beverly Hills, CA 90210
Description: Restructuring of the roles between the sexes will be illustrated in a discussion of the new family and the role which the creative working woman will have in the world of the future.

Title: Wages of Work
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley,
CA 94720
Description: Mary Keyserling and a panel of employment experts discuss why, how, when, and where women work, and effects on family, job, and community. One of the series, Choice: Challenge for Modern Woman.

Title: What's The Matter With Alice?
30 minutes, 16mm, color, 1972
Source: Newsfilms, USA/21 West 46th Street/New York City, NY
Description: Prepared for the Civil Service Commission, the film communicates an understanding of "upward mobility."

Title: The X-Factor: Women As People
30 minutes each (one inch video-tape)
Source: Cornell University/Director ETV Center/Van Rensselaer Hall/
Ithaca, NY 14850
Description: Two half-hour programs on the status and image of women, developed for a course at Cornell.

Title: Childcare: People's Liberation
20 minutes, 16mm
Source: San Francisco Newsreel/Department W/1232 Market Street/
Room 101/San Francisco, CA 94102
Description: This film reviews how mothers and children in this society tie each other down. It shows, through examples, how community-run childcare centers are a step toward liberation.

Title: Who is Sylvia?
27 minutes, B/W, 1957, #4793
Source: University of California/Extension Media Center/Berkeley,
CA 94720
Description: Study of the dreams, fears and hopes of a 14 year old girl, "half child, half woman" and of her relationships with her family, school and friends.

Title: Teach Your Children Well
30 minutes, 16mm, color
Producer: Marta Ashley; Assoc. producer: Nina Janowsky; Assistant:
Marty Coe
Source: Femedia/2286 Great Highway/San Francisco, CA 94116
Description: Documentary about three women: a Black, a Chicana, and a white woman in a comparison of how their parents educated them and how the consequences of this affects them today.

Title: Choice: Challenge for Modern Women
series of 12 films each 30 minutes, B/W, 16mm, 1967
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Twelve discussion programs designed to help women arrive at reasoned choices as they make decisions affecting themselves, their families, and society.

Title: Anything You Want To Be
8 minutes, 16mm, B/W
Filmmaker: Liane Brandon
Source: New Day Films/267 West 25th Street/New York City, NY 10001
Description: The conflicts and absurdities that beset a high school girl. She mimics female stereotypes: the wordly sophisticate, the wholesome homemaker, the sexy "chick," the sweet young thing. The film raises questions and provokes thought rather than prescribing answers.

Title: Evolving Toward Woman
60 minutes
Source: Contact Deidre Walsh, c/o The Feminist Voice for more information
Producer: Deidre Walsh
Description: The struggle of women to redefine themselves in the midst of the changes that are happening in our culture. It presents an introduction to the issues, rather than narrowing in on one specific issue. It includes rap sessions, interviews, and scenes of everyday occurrences.

Title: Growing Up Female: As Six Become One
60 minutes, 16mm, B/W
Filmmakers: Julia Reichert & James Klein
Source: New Day Films/267 West 25th Street/New York City, NY 10001; or from San Francisco Newsreel/Department W/1232 Market Street/Room 101/San Francisco, CA 94102
Description: A documentary on the socialization of women in America. The film traces this process through the lives of six females; the youngest is 4, the oldest is 35. In between, the women are students and workers, white and black. A powerful film.

Title: Woman, Wife Or What
29 minutes, 16mm, B/W
Producer and Source: KUON-TV Univ. Ed. TV Station/1600 R Street/Lincoln, NE 68508
Description: Explains that in a modern world, many modern women have feelings of being trapped, their role confused. Describes the battle for intellectual recognition and need for creative achievement.

*Title: To Be A Woman
13 minutes, 16mm, color
Source: Billy Budd Films/235 East 57th Street/New York City, NY 10022
Description: Designed as a tool to trigger re-thinking and start discussion. Girls and young women were interviewed and 18 hours of feminine voices speaking of themselves, their self-image, their attitudes, their conviction, and themselves were collected. The best statements were put into 6 sections: girlhood, personhood, feminity, anti-stereotypes, sexuality and idealism.

*Title: Women's Work: Engineering
26 minutes
Source: Massachusetts Institute of Technology/Center for Advanced Engineering Study/Cambridge, Massachusetts
Description: Designed for use by secondary school students in science, math, social studies, and career education classes. The film is intended to provide in-depth portraits of women students and professionals, giving their personal views about the opportunities, problems, and rewards of an engineering career.

*Title: Women in Science
Source: Queensborough Community College/Bayside, New York 11364
Description: This is a multimedia package containing cassette interviews, slides and articles plus references, showing the work and lifestyles of six successful contemporary female scientists. Designed for use by young women making educational and career choices.

Title: A World for Women in Engineering
Filmmaker: Bell Telephone
Source: Bell Telephone Companies/Available Fall 1976
Description: A film designed to encourage young women to consider engineering as a career. Six women engineers from Bell Labs talk about their experiences in engineering.

We understand that a number of promotional films dealing with women in science are being produced privately by various companies, including General Electric and Kodak; however, we have been unsuccessful in our attempts to locate these films, or their titles.

*Title: . . .How Many Eves
14 minutes
Filmmaker: Zelda Zeldin
Source: Women's Media Workshop
Description: A film about a woman's long, but successful, struggle to secure a promotion to the next job up the ladder, for which she is clearly the most qualified. The film illustrates the problems she encounters with a manager who thinks women should be kept in their place, her co-workers (both men and women), and her husband. The film is intended for corporations, educational institutions, and counseling and management consulting organizations. The film was produced in cooperation with the U.S. Civil Service Commission.

APPENDIX F

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APPENDIX G

SELECTED ANNOTATED BIBLIOGRAPHY

American Association of University Women Educational Foundation. Counseling Techniques for Mature Women. Washington, D.C., author, 1966. 290 p.

Report of a pilot adult counselor program, directed by Eleanor F. Dolan under contract with the Office of Manpower, U.S. Department of Labor. The consultants and participants in this program became convinced that counselors must have knowledge of adult women's psychology, information about the educational resources available, knowledge of the techniques of counseling, and information about the current job market. Women returning to work are insecure, unable to "piece together" help. They need a relationship with one person who can help them work out the basic steps. A full report, with an appendix of 158 pages containing suggested readings, syllabi, course outlines, and case histories.

An Imperative for the Seventies: Releasing Creative Womanpower: A Guide for Counselors of Mature Women. University of Missouri--St. Louis, Extension Division, 1969. 31 p.

Proceedings of a summer workshop sponsored by the University of Missouri--St. Louis, Lindenwood College and the National Association of Women Deans and Counselors. The purpose of the workshop was the exploration of the societal attitudes and emerging options for the education and employment of women in the seventies. Papers by Esther Westervelt, Gladys Harbeson, Carole Leland and Ruth Van Doren are included. A schematic cycle of the educational process for identifying, planning, implementing and evaluating programs for women, and delineation of potential target populations of women by King M. Wientge is also included.

Astin, Helen S. and Thelma Myint. "Career Development of Young Women During the Post-High School Years." Journal of Counseling Psychology, v. 18, no. 4, July 1971, p. 369-394.

This study of 5,378 women during the five year period after high school demonstrates that a certain amount of career predictability is possible. Girls who in high school score high on scholastic aptitude, especially in mathematics and who plan to go to college, usually choose fields that require greater career commitment. Plans to do office work or to be a housewife are made by girls with less aptitude and fewer academic interests. Girls who are interested in social service or health fields, but have little interest in further education usually continue to choose these fields. Full-time employment after high school, and early interest in business and management, a B.A. degree, and unmarried status proved to be the best predictors of plans to pursue a business career.

Despite the fact that close to one-half of the women studied changed their career plans during the period studied, early pattern and interests predict later career outcomes. Since many women must decide at high school graduation about future careers, counselors and educators should assume responsibility for guiding these young women to make plans most appropriate for them, especially those planning careers that require specialized training. Guidance becomes even more crucial for those girls of high ability and low aspirations who later learn that office work or being a housewife is not commensurate with their interests or abilities.

Bank, Ira M. "Children Explore Careerland through Vocational Role-Models." Vocational Guidance Quarterly, v. 17, no. 4, June 1969, p. 284-289.

The author feels that boys and girls in elementary schools are in need of experiences which can provide maximal opportunity for vocational inquiry. A broader base for vocational choice can be developed during those formative years and counselors can help build an expanded "career-land" in which the children are exposed to the world of work and workers at an early age. The individual's choice of alternatives in his future years may be enhanced by this exposure. The author describes a role-model program which was used in an elementary school and evaluates it.

Cook, Barbara. "Roles, Labels, Stereotypes: A Counselor's Challenge." Journal of the National Association of Women Deans and Counselors, v. 34, no. 3, Spring 1971, p. 99-105.

The author discusses answers to the questions: what should it mean to a counselor to have an increased awareness of culturally defined roles for men and women? How may a counselor increase her own awareness? How does a counselor's self concept affect her ability to help individual women find answers to their individual problems?

Daly, Edith M. A Theory for the Vocational Counseling of Women. Doctoral Dissertation, Ohio University, 1970. 199 p. (University Microfilm Publications No. 71-16, 483)

A study designed to develop a conceptual framework for viewing the complexities of female occupational choice and suggesting a vocational counseling process. Literature of the past ten years was reviewed. It appears, says the author, that objective knowledge of individual traits and/or of factors operative in job situations does not explain women's vocational choice processes. Research findings seem to point to what could be called a "situational" view of women's choices. The decisions women make about career patterns and specific occupations are made in the light of their own individual priorities, at a particular point in time, in relation to their perception of the meaning of a number of variables impinging upon and within them. The author discusses her theory for counseling.

Entine, Alan D. "At Mid-Life They Return to College and Change Careers." Journal of College Placement, v. 27, no. 4, April-May 1967, p. 50-57.

The director of the pilot New Careers Program at Columbia University discusses the program, and the motivations of people wishing to change careers at mid-life. He feels that the national interest in this program has "uncovered a finding broader than the original scope of the program--countless men and women wish to change their careers in the middle years."

Eyde, Lorraine. "Eliminating Barriers to Career Development of Women." Personnel and Guidance Journal, v. 49, no. 1, Sept. 1970, p. 24-28.

Women and girls need special assistance in planning careers, and vocational counselors need to consider carefully factors in their background and patterns of development, according to author. The needs of low income group women, for example, are different from those of other groups. Counseling young girls requires covering far more than traditional topics of vocational interest and aptitudes. Counselors as a whole, the author states, have been found to hold sex-stereotypes, and they need to change these attitudes. They also need to be aware of subtle changes occurring in occupations so that they can prepare women for the future instead of the past.

Fagin, Margaret C. "Analysis of the Performance of Adult Women in Missouri on Three General Examinations of the College Level Examination Program." Adult Education Journal, v. 21, no. 3, Spring 1971, p. 148-165.

One of the major purposes of the College Level Examination Program is to give adults an opportunity to secure college credit by examination. In 1967-68, three of the General Examinations of the College Level Examination were administered to 319 Missouri women, aged 25 to 73, for the purpose of comparing their test performances with those of regularly enrolled freshman and sophomore college women, and of developing normative data for adult women. Among the 10 findings listed: chronological age has no bearing on the ability of mature women to perform well on the three examinations used; recency of formal education is significantly related only to performance on the Natural Sciences Examination; level of formal education is significantly related to all three examinations. These and other findings have important implications for counselors of adults, college admissions officers and employers of mature women.

Farmer, Helen S. and Martin J. Bohn, Jr. "Home-Career Conflict Reduction and the Level of Career Interest in Women." Journal of Counseling Psychology, v. 17, no. 3, May 1970, p. 228-232.

Many women experience conflict between home and career because of the cultural lag between social opportunity and social sanction. This study was an attempt to reduce home-career conflict experimentally, by providing a measure of social sanction for demanding career roles and to measure the effect of this reduction on home and career interests. In addition, the study controlled for married/single status to determine its relevance to vocational interest when home-career conflict was reduced. It was concluded that the level of vocational interest in women, irrespective of married/single status would be raised if home-career conflict were reduced. Women's attitudes toward careers can be affected and counselors must take time to discuss some of the issues involved in the vocational choice process for women. Such clarification could be built into high school and college curricula for girls, "warranted when one considers the gain to society if women chose careers commensurate with their potential."

Fortner, Mildred L. "Vocational Choices of High School Girls: Can They Be Predicted?" Vocational Guidance Quarterly, v. 18, no. 3, March 1970, p. 203-206.

Although counselors are becoming aware of the changing patterns in labor force participation of women and the need to help girls prepare for the future, they have difficulty doing this because of lack of knowledge of factors contributing to the vocational choice of girls. This study attempts to identify some of these factors, using IQ scores, Sims Occupational Rating scale, social class and family wage earners' occupations, on a group of 400 high school juniors and seniors in Missouri and Wyoming. Results show predictions can be made.

Friedersdorf, Nancy Wheeler. A Comparative Study of Counselor Attitudes Toward the Further Educational and Vocational Plans of High School Girls. Doctoral dissertation, Purdue University, 1969. 171 p. (University Microfilm Publications no. 70-3887)

An attempt to determine the attitudes of counselors toward the educational and vocational goals of high school girls, and the extent of difference between male and female counselors. The counselors were compared in a role-playing situation where they acted as college bound high school girls and non-college bound girls. The counselors were also given the Strong Vocational Interest Blank and Personal Information Forms to complete. Some conclusions: male counselors associated college bound girls with traditional feminine occupations at semi-skilled levels, and tended to think of women in feminine roles; female counselors tended to expand the traditional image of female work roles; male counselors perceived the college bound girl as having positive attitudes toward traditionally feminine occupations regardless of the classification level of the occupation. Such perceptions may affect the higher educational and vocational goals of the female student. Recommendations and suggestions for public school programs to expand occupational horizons for women are presented.

Gardner, Joann. "Sexist Counseling Must Stop." Personnel and Guidance Journal, v. 49, no. 9, May 1971, p. 705-714.

The author states "Today, it is probably not a serious misrepresentation to say that all counselors are sexist." The myths about women need to be eliminated and texts and curricula from prereading on need revision so that children will develop aspirations according to their individual characteristics rather than to their sex. She suggests that counselors must take courses taught by feminists, participate in consciousness-raising groups, and pursue internships supervised by feminists.

Hall, Guin. "A New Look at Women and Vocations." American Vocational Journal, v. 39, no. 4, April 1964, p. 25.

The author contends that education has a responsibility to the girl in school and to the women wishing to re-enter the job market. Vocational schools might explore job orientation courses and women's organizations might sponsor job clinics where free guidance by career specialists could be given. There is also a need for educators, especially vocational teachers, to meet more frequently with business and industry personnel, and employment agency personnel.

Johnson, Ray W. "Parental Identification and Vocational Interests of College Women." Measurement and Evaluation in Guidance, v. 3, no. 3, Fall 1970, p. 147-151.

The subjects in this study were tested for occupational interests and identification with mother or father. From the results it would seem that women with interests in areas that are basically scientific tend to identify more with their fathers than their mothers. The results further suggest that identification with the mother, as measured by the technique of this study, is not a major consideration in the formation of the sex-typical occupational interests. Career interests are not necessarily associated with masculine identification but mathematical-scientific interests may be so associated.

Levine, Adeline Gordon. Marital and Occupational Plans of Women in Professional Schools: Law, Medicine, Nursing, Teachin[illegible] Doctoral dissertation, Yale University, 1968. 139 p. (University Microfilm Publications no. 69-13, 353)

Social class, background factors, future plans and current experiences of students at four professional schools were studied. Two of the schools (law, medicine) were characterized as masculine fields, the other two as feminine. It was found that women in the masculine field schools came from higher social class backgrounds, and had mothers who were better educated and approved of a variety of career roles for women. These findings were interpreted as showing that not only the financial resources to implement career choices, but models of orientation toward female occupational and educational roles differed between career field groups.

Lewis, Edwin C. Developing Women's Potential. Ames, Iowa, Iowa State University, 1968. 389 p.

A survey of existing research on women, including ability, education, employment, careers and guidance. The author summarizes the research which is frequently conflicting. An extensive bibliography is included.

McHugh, William Thomas. A Study of the Differences in Self-Concept and Occupational Role Concepts of Young Women and Middle-Aged Women In Occupational Training Programs. Doctoral dissertation, University of Oregon, 1970. 96 p. (University Microfilm Publications no. 71-1333)

The theory that an individual uses her occupational choice as a means of self-actualization was the position of this study. The study investigates the effects of age on the relationships between self-concept and occupational role concepts. The analyses of data in all areas of the study revealed no significant differences between the middle-aged women and younger women of this study, who were in the final stages of professional and semi-professional training at an urban community college. If, however, the directional pattern of the differences in mean scores are not due to chance, then some conclusions can be proposed. The author discusses these.

MacPherson, Lucille I. The Effects of Social Class on Females' Perceptions of Traditional Sex Role Adherence in Occupations. Doctoral Dissertation, Arizona State University, 1971. 82 p. (University Microfilm Publications no. 71-5981)

The premise of this thesis is that social class membership influences perceptions of traditional sex-role adherence in occupations and these perceptions in turn affect occupational choice. The analysis revealed significant differences between the responses of the high school seniors in three social classes for semi-professional, managerial, skilled, and semi-skilled occupations. Sex role adherence appeared to be a function of social class membership. To the extent that this population studied is representative of female high school seniors, it can be concluded that social class is an important factor influencing perceptions of sex role stereotypes in occupations. These findings help toward a better understanding of some factors involved in girls' occupational decision making and subsequent development of a theory of vocational choice for women.

Masih, Lalit K. "Career Saliency and Its Relation to Certain Needs, Interests, and Job Values." Personnel and Guidance Journal, v. 45, no. 7, March 1967, p. 653-658.

The high career-salient woman, according to this study, shows a high need for achievement and perceives herself as capable of enduring long periods of work. She indicates a strong desire for fame but is less concerned with prestige. However, this is a small portion of the women tested and compared to men, a much smaller proportion. According to the author "the recognition of these differences is essential for any successful counseling program . . . a program more oriented toward nonoccupational interests and motivations might go a long way in clarifying the goals of women."

Matthews, Esther and David V. Tiedeman. "Attitudes Toward Career and Marriage and the Development of Life Style in Young Women." Journal of Counseling Psychology, v. 11, no. 4, Winter 1964, p. 375-384.

A study of 1237 girls, representing the developmental stages of early adolescence, adolescence and young adulthood and their attitudes toward career and marriage. One interesting finding is the drop in career commitment from junior to senior high school. The high school group showed a greater acceptance of marriage. The authors feel that a major theme which appeared in the responses is that women feel that men take a dim view of the expression of women's intelligence, and it is therefore wise to accept this situation if one wishes to marry.

Mooney, Robert Francis. A Multiple Discriminant Analysis of the Interest Patterns of High School Girls. Doctoral dissertation, Boston College, 1968. 147 p. (University Microfilm Publications no. 69-12, 329)

This study attempted to discover if significant differences exist among college preparatory high school girls categorized into broad occupational preference groups. It also attempted to examine the nature of any differences and classify girls into occupational preference groups on the basis of these differences. Results showed that the interest patterns of many high school girls seem to crystallize by the time they enter 10th grade. It further showed, according to the author, that it was possible to classify girls, on the basis of their interest pattern into more specific occupational groups than science or non-science. The classification procedures of this study might suggest to the guidance counselor a new and effective method for helping high school girls to select appropriate careers.

Mowesian, Richard. "Educational and Career Aspirations of High School Females." Journal of the National Association of Women Deans and Counselors, v. 35, no. 2, Winter 1972, p. 65-70.

According to the author, this study implies that girls are not satisfied to enter the labor market in just any job but have definite post high school objectives as well as levels of occupational aspirations. If the data from this investigation of girls in Texas can be accepted as representational of our adolescent female population, then there are some implications that counselors will need to consider in career planning with the girls. The author lists and briefly discusses four considerations.

New Patterns of Employment. Proceedings of the Conference-Workshop, March 29, 1966, Center for Continuing Education of Women. Ann Arbor, Mich., University of Michigan, 1966. 143 p.

Many women wish to resume their interrupted formal education, or enter new fields, but they want to be trained in a field where their services will be needed. The emphasis of this conference is to discover the most promising fields of employment for the educated mature women who want to work only a twenty to thirty hour week because of family responsibilities.

Ohlsen, Merle M. "Vocational Counseling for Girls and Women." Vocational Guidance Quarterly, v. 17, no. 2, Dec. 1968, p. 124-127.

Because society's influence has not encouraged girls to take seriously the choice of an out-of-home career, the author feels that the counselor must make special efforts to cope with the sex role problems and encourage girls to enter responsible positions in business, industry and the professions.

Okun, Barbara F. "Later Careers of Women College Graduates." Journal of the National Association of Women Deans and Counselors. v. 35, no. 2, Winter 1972, p. 83-89.

Increasingly, counselors are having to deal with the problems of the extended work life of the mature woman. If more were known about the potential influences--early work, education, familial experiences--counselors would be better able to help college girls identify the kind of variables they should consider during their forthcoming career and homemaking periods. Counselors would then have a better understanding of the special considerations necessary in the study of women's occupational choices. The purpose of this study was to identify the factors that determine the occupational choices of a married women 12 to 20 years after college graduation following a period of at least seven years as a homemaker.

Rezler, Agnes G. "Characteristics of High School Girls Choosing Traditional or Pioneer Vocations." Personnel and Guidance Journal, v. 45, no. 7, March 1967, p. 659-665.

Junior and senior girls in a Catholic girls' high school in the mid-west were the subjects of this study. The characteristics of girls who wished to be pioneers, i.e., physicians, mathematicians, scientists, were compared with traditionals, i.e., nurses, elementary school teachers. Academic aptitude, interest, achievement and personality differentiated pioneers from traditional. From the results it seems clear to the author that prospective pioneers can be separated from traditionals by the time of the junior year in high school. The implications of this for counseling high school girls is discussed.

Schissel, Robert F. "Development of a Career-Orientation Scale for Women." Journal of Counseling Psychology, v. 15, no. 3, May 1968, p. 257-262.

This study developed a Career-Orientation Scale which discriminates between career and non-career oriented women on the basis of interest. The results were favorable to the hypothesis that areas of interest of women classified as "career oriented" differed significantly from those of "non-career oriented" women. There is evidence that women can be ordered along a continuum of career orientations on the basis of their interests.

Sedlacek, Caroline Gladys. Selected Factors Affecting Certainty and Persistence of Vocational Choice for College Women. Doctoral dissertation, University of North Dakota, 1968. 123 p. (University Microfilm Publications no. 69-8567)

The purpose of the study was to investigate vocational choice and persistency in relation to the college factors: type of vocational choice, vocational interest patterns, personality needs, academic ability and performance, and family background. The study was done in two steps with follow-up questionnaires. Some findings for the first part: more women from the "very certain" vocational choice and "fairly certain" groups chose traditional vocations than the "uncertain" group; the "very certain" group scored lower than the other groups on the mathematics and natural science tests. Findings of the second part revealed that by the end of the second year in college 90 percent of the women were preparing for traditional feminine vocations. Women who had been "certain" or "fairly certain" of their freshman vocational choice tended to change their vocational choice.

Stafford, Rita Lynne. "A Study of the Process of Vocational Development in Professional Women." Journal of the National Association of Women Deans and Counselors, v. 30, no. 4, Summer 1967, p. 190-192.

This study of outstanding women in New York State who had been practicing in the fields of law, medicine, dentistry, nursing and educational administration, showed that with the exception of educational administration, approximately one-fifth of the respondents "knew" prior to the age of 12 that they wanted to enter the field in which they are presently engaged. By the time they had entered college, 26 percent of the attorneys knew law was their chosen profession, 45 percent of the doctors had decided on medicine, 17 percent of the educational administrators had chosen the educational world and 19 percent of the nursing administrators had made their decisions. These results, in conjunction with tables reveal that influential persons, attitudes, and events combined with data concerning youthful career interests should cause educational institutions to re-examine their patterns of student guidance.

Steinmann, Anne. "Female Role Perception as a Factor in Counseling." Journal of the National Association of Women Deans and Counselors, v. 34, no. 1, Fall 1970, p. 27-33.

The author, who has conducted many studies on sex role concepts, states, "Irrespective of age, marital status, race, education or socio-economic status, women seem to be ambivalent with respect to home and career." Counselors must now identify this problem of girls at an early age to help them make appropriate choices in resolving it. Since counseling is now more than curricular advice and since role conflict is so prevalent, the need for early counseling in school is especially urgent. Without such help, "women are likely to experience frustration in whatever role they choose." The present study is an attempt to uncover the bases for the role-conflict by investigating a group of college women. Evidence suggests strongly that counselors must consider the potential life-style of young women clients against the background of the views and life-styles of their parents. Parents' attitudes represent both a direction and a limitation for young women. Every young woman must be helped to make an early start in assessing her own needs and measuring these needs in relation to the environment. In addition, all concerned with the need to help young women plan must continually stress the need for universal free day care. "Ultimately only this will give women the opportunity to choose freely between home and career."

Tennyson, W. Wesley, Thomas A. Soldahl, and Charlotte Mueller. The Teacher's Role in Career Development. Washington, D.C., National Vocational Guidance Association, 1965. 107 p.

Revised edition of a Minnesota Department of Education publication. According to the authors, an effective guidance program is dependent to a considerable extent on the active participation of classroom teachers. Teachers can make an important contribution in pointing out the relationship of the subjects they teach to various careers. The focus of this publication is on the methods and media for relating subject matter to vocational development.

Thomas, Arthur S. and Norman R. Stewart. "Counselor Response to Female Clients with Deviate and Conforming Goals." Journal of Counseling Psychology, v. 18, no. 4, July 1971, p. 352-357.

Counselors, along with women, are struggling with the discrepancies between stereotypes of the past and the current societal changes. This study was designed to test the response of secondary school counselors to girls who select traditional occupations and those who select what are considered masculine goals (deviate). Sixty-four counselors were tested. Results were: Female counselors were more accepting of both types of girls than male counselors; counselors, regardless of sex, rated conforming goals as more appropriate than deviating goals; counselors, regardless of sex, rated girls with deviate career goals to be more in need of counseling than those with conforming goals. Details of the study and implications are discussed.